3. 討議議事録覚書 (Minutes of Meetings : M／M)

MINUTES OF MEETING
BETWEEN THE JAPANESE IMPLEMENTATION STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE ARGENTINE REPUBLIC ON THE JAPANESE TECHNICAL COOPERATION FOR THE PROJECT ON REGIONAL GEOLOGICAL MAPPING WITH ADVANCED SATELLITE DATA IN THE ARGENTINE REPUBLIC

The Japanese Implementation Study Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Masahiko Kaneko, visited the Argentine Republic from December 18 to December 21, 2000 for the purpose of working out the details of the Japanese Project-Type Technical Cooperation for the Project on Regional Geological Mapping with Advanced Satellite Data (hereinafter referred to as "the Project").

During its stay in the Argentine Republic, the Team exchanged views and had a series of meetings on the Project with the authorities concerned of the Government of the Argentine Republic (hereinafter referred to as "the Argentine side")

As a result of the meetings, both sides reached common understandings concerning the matters referred to the documents attached hereto.

Buenos Aires, December 21, 2000

金子正彦

Mr. Masahiko Kaneko
Leader
Implementation Study Team
Japan International Cooperation Agency
Japan

Mr. Roberto F. N. Page
President
Argentine Geological and Mining Survey
(SEGEMAR)
The Argentine Republic

ATTACHED DOCUMENT

1 Name of the Project

Both sides agreed to use "The Project on Regional Geological Mapping with Advanced Satellite Data" as the name of the Project.

2 Implementing Agency of the Project

Argentine Geological and Mining Survey (Servicio Geologico Minero Argentino, hereinafter referred to as "SEGEMAR") under supervision of Secretariat of Energy and Mining, Ministry of Economy, will bear overall responsibility for the implementation of the Project.

The Project will be implemented at Geology and Mineral Resources Institute (Instituto de Geologia y Recursos Minerales, hereinafter referred to as "IGRM").

The present organization chart of SEGEMAR and IGRM is as shown in ANNEX 1.

3 Administration of the Project

President of SEGEMAR, as the Project Director, will bear overall responsibility for the coordination and implementation of the actions and proceedings in order to achieve the general goals of the Project.

Director of IGRM, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

Director of Regional Geology Direction, Acting Director of Remote Sensing and GIS Division, Director of Geological and Mining Resources Direction, and Director of Environmental and Applied Geology Direction, as the Coordinators, will assist the Project Manager for the managerial and technical matters of the Project, such as planning, allocating budget, assigning necessary staff, monitoring, and coordinating with organization and/or directions concerned.

The organization chart for the administration of the Project is as shown in ANNEX 2.

4 Duration of the Project

The duration of the technical cooperation for the Project will be four (4) years from March 1, 2001.

5 Site of the Project

The Project will be implemented at IGRM. The present address is as follows:

Address:Av. Julio A. Roca 651, 1322, Buenos Aires

The location map of the present premise is as shown in ANNEX 3.

The Argentine side explained to the Team that it had abandoned the plan to move the Project site to another premise before or during the Project period. The Team also requested that the Project site should not move during the Project period because it is necessary to fix it for smooth implementation of the Project.

6 Master Plan of the Project

(1) Super Goal A

Geological maps and thematic maps prepared by IGRM are utilized by mining investors in Argentine.

(2) Overall Goal A

Geological maps and thematic maps for mineral exploration using advanced satellite data are prepared by IGRM.

(3) Project Purpose A

IGRM is able to utilize advanced satellite data such as Advanced Spaceborne Thermal Emission and Reflection Radiometer (hereinafter referred to as "ASTER") and/or PALSAR (Synthetic Aperture Radar sensor currently under development in Japan) in order to make geological maps and thematic maps for mineral exploration.

(4) Outputs A

1. System for utilizing satellite data is established in IGRM.
2. Equipment and satellite data are managed and maintained properly.
3. IGRM geologists have enough technology to utilize advanced satellite data such as ASTER and/or PALSAR on geological and thematic mapping for mineral exploration.
4. Usefulness of the remote sensing technology is understood by the persons concerned and users through seminars and workshops.

(5) Overall Goal B

Thematic maps for environmental conservation and hazard prevention are prepared by IGRM.

(6) Project Purpose B

IGRM understands how to utilize advanced satellite data such as ASTER and / or PALSAR in environmental or hazardous area study.

(7) Outputs B

1. System for utilizing satellite data is established in IGRM.
2. Equipment and satellite data are managed and maintained properly.
3. IGRM geologists understand how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental and hazardous area study.

7 Fields of Technology Transfer

Both sides agreed that technology transfer from the Japanese experts to the Argentine counterparts (hereinafter referred to as "C/P") would be made in the following fields.

1. Data handling and fundamental concept of earth resources satellite data
2. Digital image processing and thematic mapping of alteration minerals and lithology with silica content by ASTER data
3. Application of ASTER data to geological mapping and mineral resources exploration
4. Microwave analysis using PALSAR data
5. Introduction to environmental analysis using ASTER and/or PALSAR data
6. Introduction to hazardous area analysis using ASTER and/or PALSAR data
7. Introduction to hyperspectral data analysis

The details of the fields of technology transfer are described in ANNEX 4.

8 Concept on Flow of Products and their Application in the Project

Both sides agreed that concept on flow of products, and their application for specific objectives as a whole, and the scope of the Project which is determined in "6 Master Plan" and “7 Fields of the Technology Transfer" within the flow is as shown in ANNEX 5.

9 Measures to be taken by the Japanese Side

The project will be carried out under the framework of Project-Type Technical Cooperation, which is the combination of the following three (3) components:

(1) Dispatch of Japanese Experts

(Long-term experts)

Both sides agreed that long-term experts would be dispatched in the following fields.

1. Chief advisor
2. Coordinator
3. Digital image processing
4. Geological remote sensing

(Short-term experts)

Both sides agreed that short-term experts would be dispatched in specific fields in relation to the fields of technology transfer as necessity arises.

At this moment, the experts in the following fields are expected to be dispatched:

1. Introduction of ASTER
2. Installation of softwares
3. Installation of data management system
4. SAR data application
5. Environmental analysis
6. Hazardous area analysis
7. Hyperspectral data application

The requesting form for dispatch of Japanese experts (Form A1) should be submitted to the Government of Japan by the Argentine side at least two (2) months prior to the scheduled arrival date to the Argentine Republic.

(2) Training of C/P in Japan

The Team explained that a certain number of C/P would be accepted for training in Japan during the cooperation period according to the following program:

1. Number : Approximately two (2) yearly
2. Term : About a couple of weeks to two (2) months, depending upon the fields as well as the C/P dispatched to Japan
3. Fields : Remote sensing

The Team, further, requested the Argentine side and the latter agreed that the C/P may apply to other training courses conducted by JICA, however, sufficient consultation should be held between the Japanese experts and the C/P before the application to avoid impeding the smooth implementation of the Project.

The application form for the training program in Japan (Form A2A3) should be submitted to the Government of Japan by the Argentine side at least two (2) months prior to the scheduled arrival date to Japan.

(3) Provision of Equipment

Both sides confirmed the machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for technology transfer in the Project as shown in ANNEX 6, which is divided into the two (2) categories.

Among these three categories, the Argentine side requested to the Japanese side the provision of the Equipment shown as Category A.

The Team agreed to convey the request of the Argentine side as for the other Equipment in Category A to the Japanese authorities concerned, stating that the actual provision will be subject to the budget appropriation of the Government of Japan.

The Team explained and the Argentine side agreed that the costs and responsibility necessary for domestic transport, installation, adjustment, maintenance and repair of the Equipment should be borne by the Argentine side.

The requesting form for provision of equipment (Form A4) should be submitted to the Government of Japan by the Argentine side immediately after R/D has been signed.

10 Measures to be taken by the Government of the Argentine Republic

(1) Buildings and Facilities for the Project

The Argentine side will prepare the building and facilities necessary for the implementation of the Project. The layout of the present building and rooms is as shown in ANNEX 7. The provisional layout of facilities and equipment necessary for the Project is as shown in ANNEX 8.

Furthermore, office spaces for the Japanese experts which are equipped properly with office equipment such as phones and a facsimile which have at least four (4) extension line for Japanese experts, one (1) international telephone line, electric wiring, LAN, and desks, will be prepared before the start of the Project.

(2) Long Term Assignment of C/P

For the successful implementation of the Project, the Argentine side will provide the full time and part time services of C/P who are listed in ANNEX 9 and the administrative personnel.

Should the allocation of C/P and the administrative personnel be changed for either the personnel or administrative reasons, the Argentine side will immediately take necessary measures to supplementarily assign appropriate number of personnel for the Project.

(3) Machinery, Equipment and Materials

The Argentine side will supply at its own expenses machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided by the Government of Japan through JICA.

The Equipment that is now existing at IGRM and is able to be utilized for the Project is shown as Category B in ANNEX 6.

(4) Local Costs

The necessary amount of local costs borne by the Argentine side will be indispensable for the successful implementation of the Project.

In this regard, both sides confirmed that the cost necessary for operation of the Project, which is listed below, is to be borne by the Argentine side.

1. Expense for transportation of satellite data from Japan to Argentine
2. Field allowance and transportation for ground truth
3. Expense for sample analysis

4. Allocation of temporary supportive staff for data processing, ground truth, etc.
5. Expense for workshops and seminars
6. Expense for consumable, electricity, etc.

The Argentine side presented the budgetary plan for these costs, which is shown as ANNEX 10.

11 Obtaining ASTER Data

The Team explained to the Argentine side and the latter agreed as follows.

- The Japanese side provides ASTER data which is necessary for technology transfer during the Project period. The range of the necessary data for technology transfer is decided by the Japanese authorities concerned, considering the request of the Argentine side and the advice of the Japanese experts. The timing of the data provision is scheduled in the middle term or the second half of the Project period, after considerable amount of good quality data is acquired by Earth Remote Sensing Data Analysis Center (hereinafter referred to as "ERSDAC")
- The Argentine side bears the cost of ASTER data other than the data provided by the Japanese side.
- It is preferable that the ASTER data needed for technology transfer until provided by the Japanese side should be obtained free of charge through the ASTER Announcement of Research Opportunity (hereinafter referred to as "ARO"), which is a joint research program executed by ERSDAC. To participate in ARO, the Argentine side submits application to ERSDAC after consultation with the Japanese experts after the Project starts. In addition, the Argentine side pays to ERSDAC the necessary expense for transportation of the data provided in ARO from Japan to Argentine.

12 Schedule of the Project

Both sides agreed on the Tentative Schedule of Implementation for the Project as shown in ANNEX 11.

Furthermore, both sides agreed on the Plan of Operations (hereinafter referred to as "PO") and Annual Plan of Operations (hereinafter referred to as "APO") for the Japanese fiscal year 2001 for the Project as shown in ANNEXES 12 and 13, respectively.

The PO and APO are regarded as tentative and should be discussed further between the Japanese experts and the Argentine side after the Project starts.

13 Project Cycle Management

(1) Application of Project Cycle Management Method

Both sides reconfirmed that project planning, monitoring and evaluating method entitled Project Cycle Management (hereinafter referred to as "PCM") will be applied to the Project to monitor and evaluate the level of the achievement and enhance the communication for its smooth implementation.

(2) Project Design Matrix

Both sides reconfirmed that the Project Design Matrix (hereinafter referred to as "PDM") ought to be designed at the planning stage of the Project, as a framework clarifying the multi-level chain of cause-to-effect such as input to output, output to project purpose, and project purpose to overall goal.

Then, both sides agreed on the PDM as shown in ANNEX 14 and reconfirmed the following:

a. The Coordinators and the Japanese experts should examine the indicators in the planning stage of the Project, which is scheduled within six (6) months after the Project starts, so that indicators and/or targets for project purpose and outputs should be as objectively verifiable as possible.
b. PDM should continue to be reviewed and revised if necessary, with further discussion between both sides.

(3) Monitoring

Both sides agreed on the following:

a. Based on PDM, regular monitoring on the achievement of the Project should be implemented primarily by the Coordinators and the Japanese experts, in order to grasp the progress and the achievement of the Project and to modify the plan and take necessary actions for smooth implementation.
b. Within the first 6 months after the commencement of the Project, the Coordinators and the Japanese experts should establish the monitoring plan and system which is drafted in ANNEX 15, and thereafter, monitoring should be done and the result should be distributed to the organizations and/or personnel concerned with the Project.

(4) Evaluation

Both sides agreed on the following:

a. Evaluation of the Project is to be conducted, based on the five basic evaluation components as shown in ANNEX 16.
b. The midterm evaluation will be conducted jointly by both sides in the middle of the cooperation period, in order to examine the achievement of the Project and modify the plan if necessary.
c. The final evaluation of the Project will be conducted jointly by both sides, approximately 6 months before the termination of the cooperation period, in order to examine the achievement of the Project.

14 Common Language

Both sides confirmed that the common language used in any activities of the Project should be English.

15 Project Document

Both sides confirmed the contents of the Project Document, which is shown in ANNEX 17.

16 Attendants at the Meeting

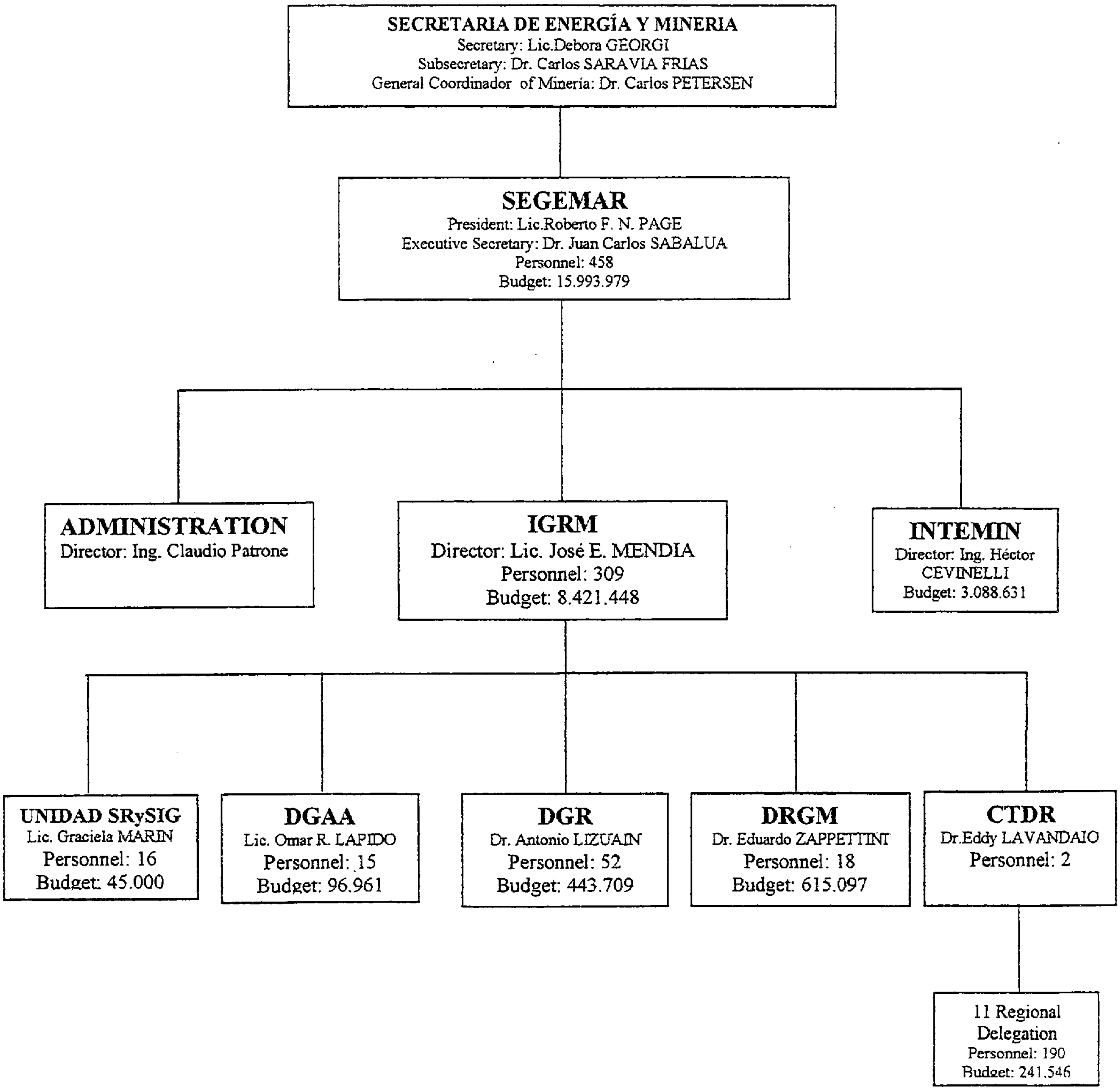
The list of attendants at the meetings is as shown in ANNEX 18.

LIST OF ANNEXES

ANNEX 1	Present organization chart of SEGEMAR and IGRM
ANNEX 2	Organization chart for the administration of the Project
ANNEX 3	Location map of the premise
ANNEX 4	Details of the fields of technology transfer
ANNEX 5	Concept of the technology, products and their application in the Project
ANNEX 6	Equipment necessary for technology transfer in the Project
ANNEX 7	Layout of the present building and rooms
ANNEX 8	Provisional layout of necessary facilities and equipment
ANNEX 9	List of full-time and part-time counterpart
ANNEX 10	Budgetary plan of the cost necessary for operation of the Project which is to be borne by the Argentine side
ANNEX 11	Tentative Schedule of Implementation (TSI)
ANNEX 12	Plan of Operations (PO)
ANNEX 13	Annual Plan of Operations (APO) for the Japanese fiscal year 2001
ANNEX 14	Project Design Matrix (PDM)
ANNEX 15	Monitoring and evaluation plan
ANNEX 16	Five basic evaluation components
ANNEX 17	Project Document
ANNEX 18	List of attendants at the meetings

ANNEX 1

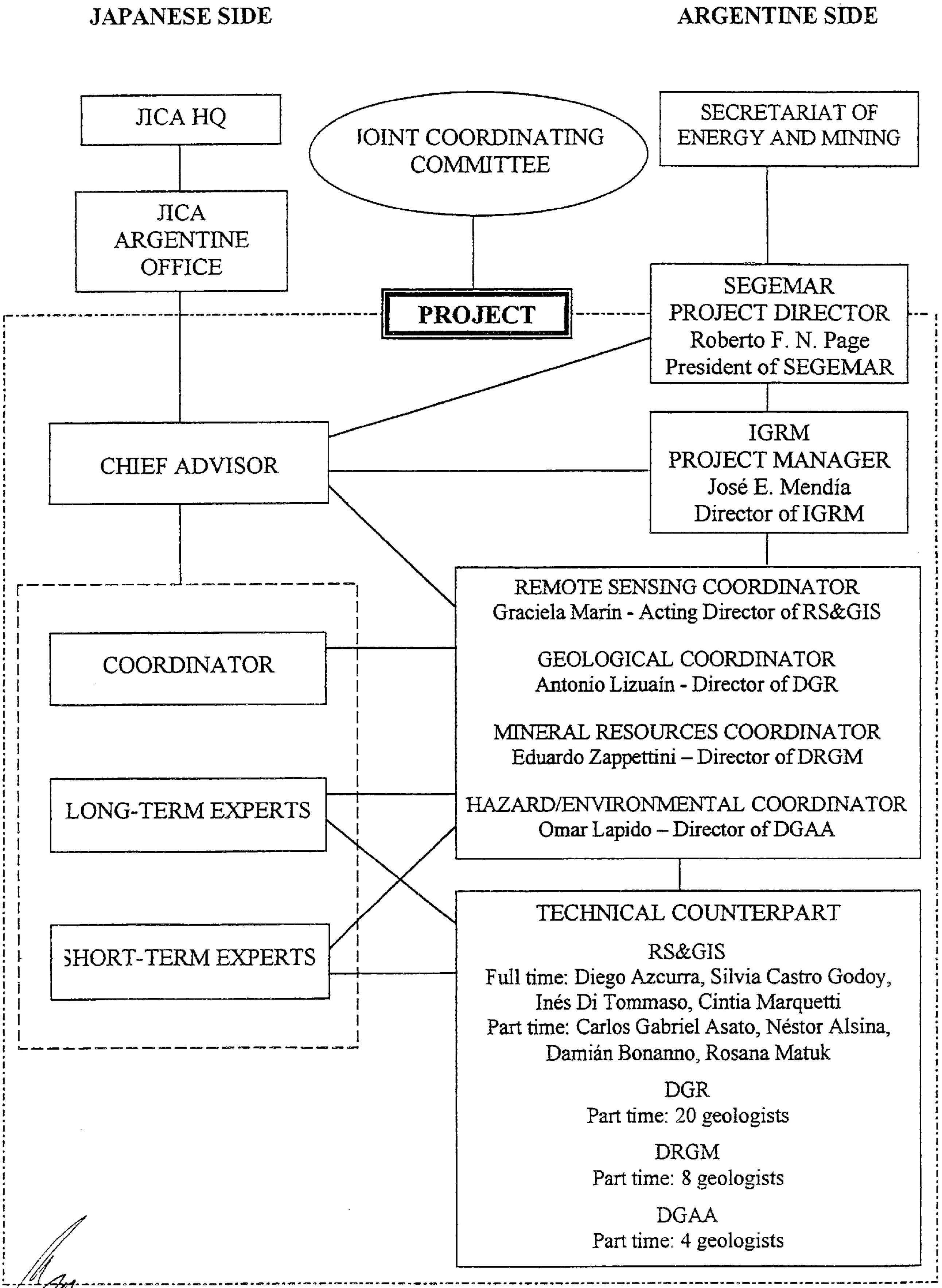
ORGANIZATION , 2000 BUDGET AND STAFF

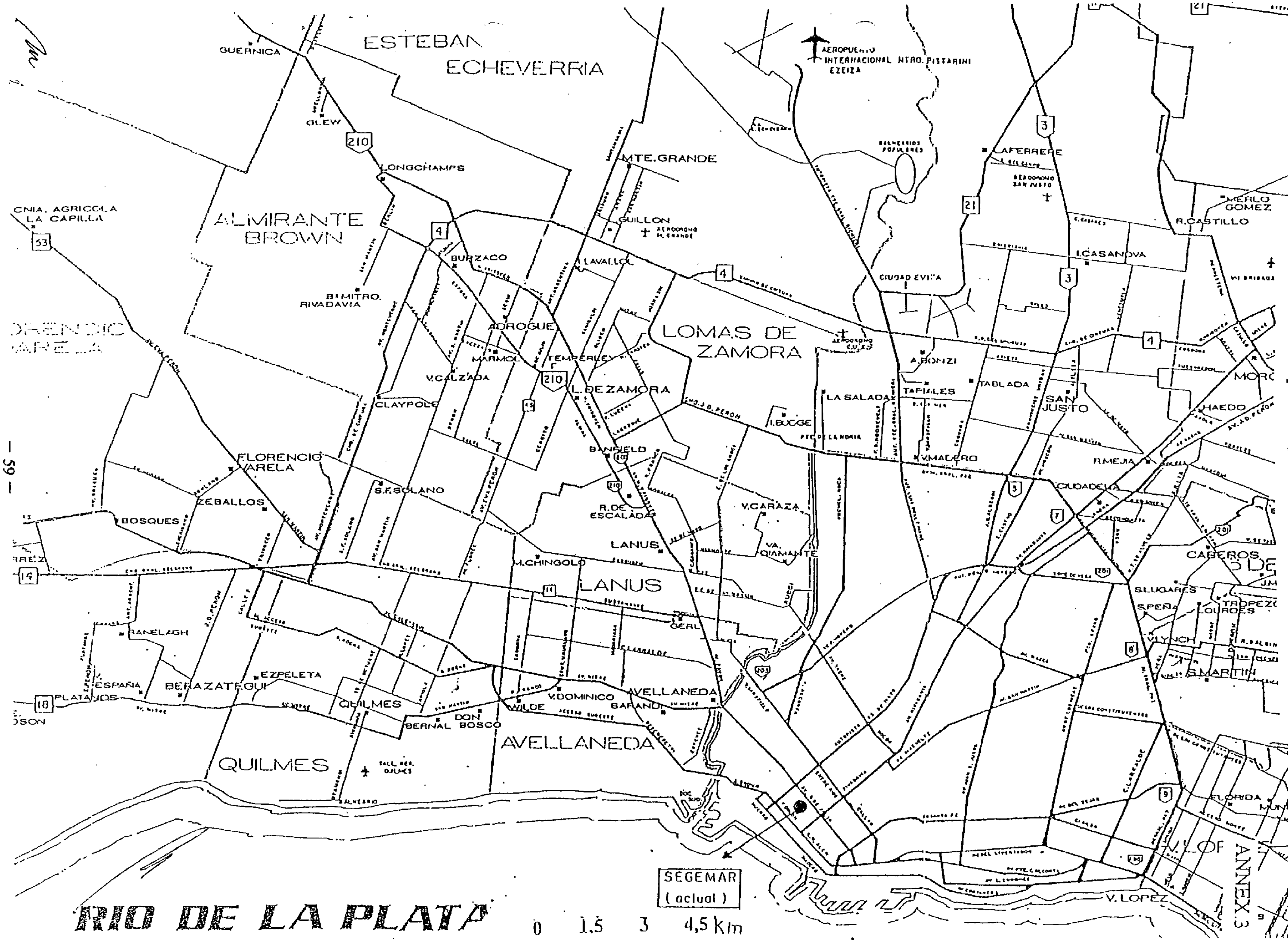


SEGEMAR – Servicio Geológico Minero Argentino (Argentine Geological and Mining Survey)
IGRM – Instituto de Geología y Recursos Minerales (Geology and Mineral Resources Institute)
INTEMIN – Instituto de Tecnología Minera (Mining Technology Institute)
DGAA – Dirección de Geología Ambiental y Aplicada (Environmental and Applied Geology Direction)
DGR – Dirección de Geología Regional (Regional Geology Direction)
DRGM – Dirección de Recursos Geológico-Mineros (Geological and Mining Resources Direction)
UNIDAD SRySIG – Unidad de Sensores Remotos y Sistemas de Información Geológica
(Remote Sensing and Geographic Information System Division)
CTDR – Coordinación Técnica de Delegaciones Regionales (Coordination of Regional Delegations)

ANNEX 2

ORGANIZATION CHART OF THE PROJECT





Location map of the present premise

ANNEX.3

Details of the fields of technology transfer

I. Data handling and fundamental concept of earth resources satellite data

1. Introduction to new hardware and software
    - a. Hardware management
    - b. Software handling (remote sensing, GIS, others)
    - c. Data management (raw data, image products)
2. Basic concept of remote sensing and its application to geological use
    - a. Visible and near-infrared (VNIR), and short-wave infrared (SWIR) sensing
    - b. Thermal infrared (TIR) sensing
    - c. Stereoscopic image and digital elevation model (DEM)
    - d. Microwave sensing
    - e. Satellite platform, orbit, data acquisition
    - f. Case studies of geological mapping based on various remote sensing data
3. Effective use of ASTER data from pre-launch studies

II. Digital image processing and thematic mapping of alteration minerals and lithology with silica content by ASTER data

1. Pre-processing (data loading, line replacing, geometric correction, mosaicking)
2. Image enhancement (stretching, filtering, statistical treatment, fast Fourier transform, others)
3. SWIR analysis
    - a. Methodology to obtain apparent reflectance
    - b. Construction and management of spectral library
    - c. Methodology of mapping alteration minerals (binary encoding, spectral angle mapping, matched filtering, spectral unmixing, others)

4. TIR analysis

    a. Separation of emissivity from temperature

    b. Silica abundance estimation based on emissivity spectra

III. Application of ASTER data to geological mapping and mineral resources exploration

1. Alteration mineral mapping based on SWIR data

    a. Three-dimensional interpretation of common hydrothermal systems

    b. Geological interpretation based on SWIR mapping results

    c. Field verification for improving mapping quality

    d. Operation of spectrometer and data acquisition of reflectance spectra in the field

2. Lithologic mapping by TIR data

    a. Extraction of silica-introduced portion in hydrothermal systems

    b. Lithologic interpretation based on emissivity spectra

    c. Field verification for improving mapping quality

    d. Operation of radiometer and data acquisition of field emissivity spectra

3. Application of DEM data to geology

    a. Data handling and analytical method

    b. Geological analysis by DEM

4. Integration of remote sensing analysis and geological field survey

    a. Comprehensive analysis of VNIR/SWIR/TIR mapping results

    b. Integrated Interpretation of geology and mineral resources (mineral potential analysis)

IV. Microwave analysis using PALSAR data

1. Data handling and image processing (data loading, noise mitigation, correction of distortion, mosaicking, others)

2. Land use analysis (forest analysis) by radar polarimetry

3. Topographic analysis by radar interferometry

V. Introduction to environmental analysis using ASTER and/or PALSAR data

1. Land use analysis (provisional)

2. Vegetation index analysis (provisional)

3. Soil index analysis (provisional)

VI. Introduction to hazardous area analysis using ASTER and/or PALSAR data

1. Flood level observation (provisional)

2. Coastal line monitoring (provisional)

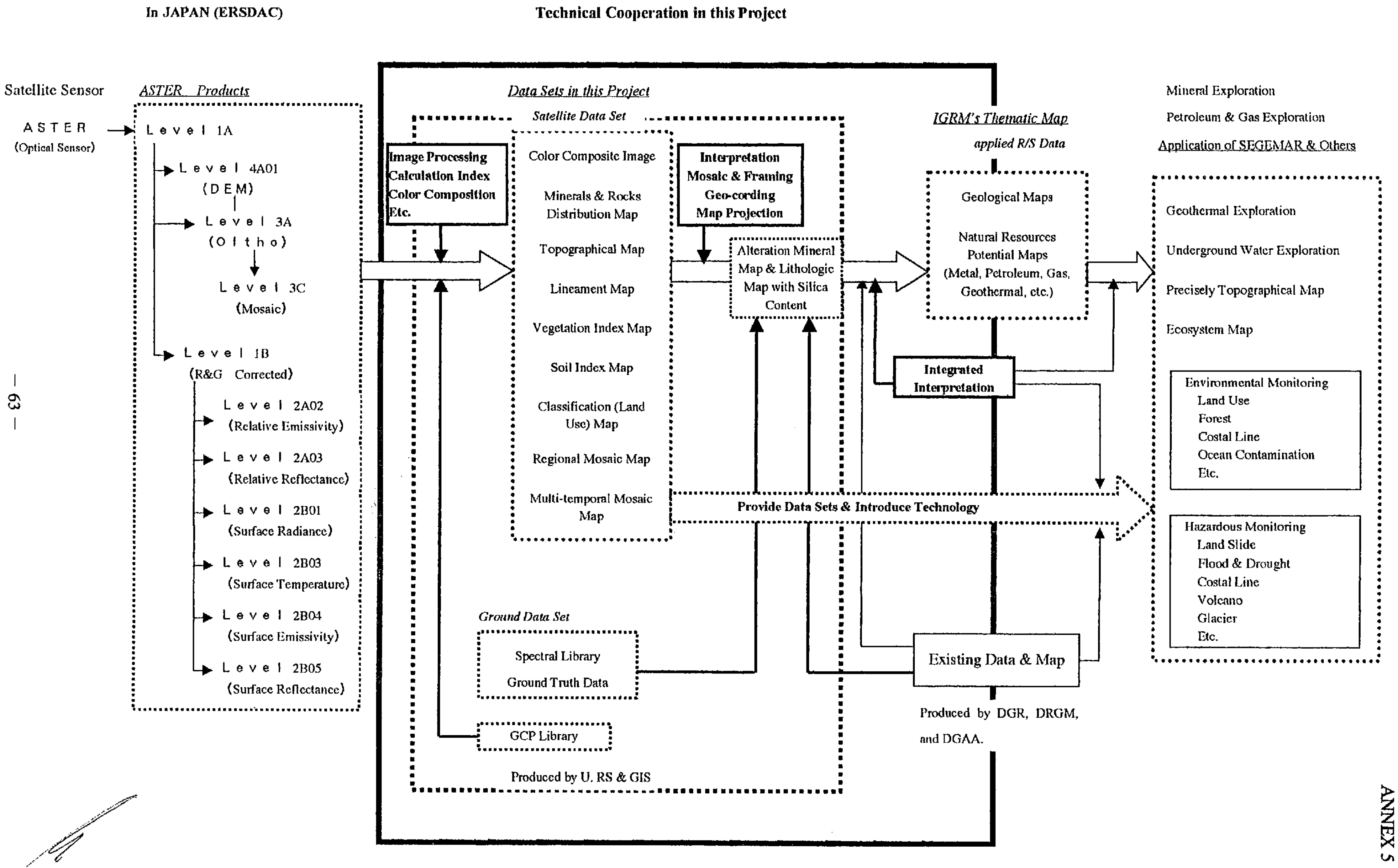
3. Drought monitoring (provisional)

4. Volcano monitoring (provisional)

5. Land slide monitoring (provisional)

VII. Introduction to hyperspectral data analysis

Concept on Flow of Products and Their Application in the Project



ANNEX 5

ANNEX 6

Equipment necessary for technology transfer in the Project

Category A

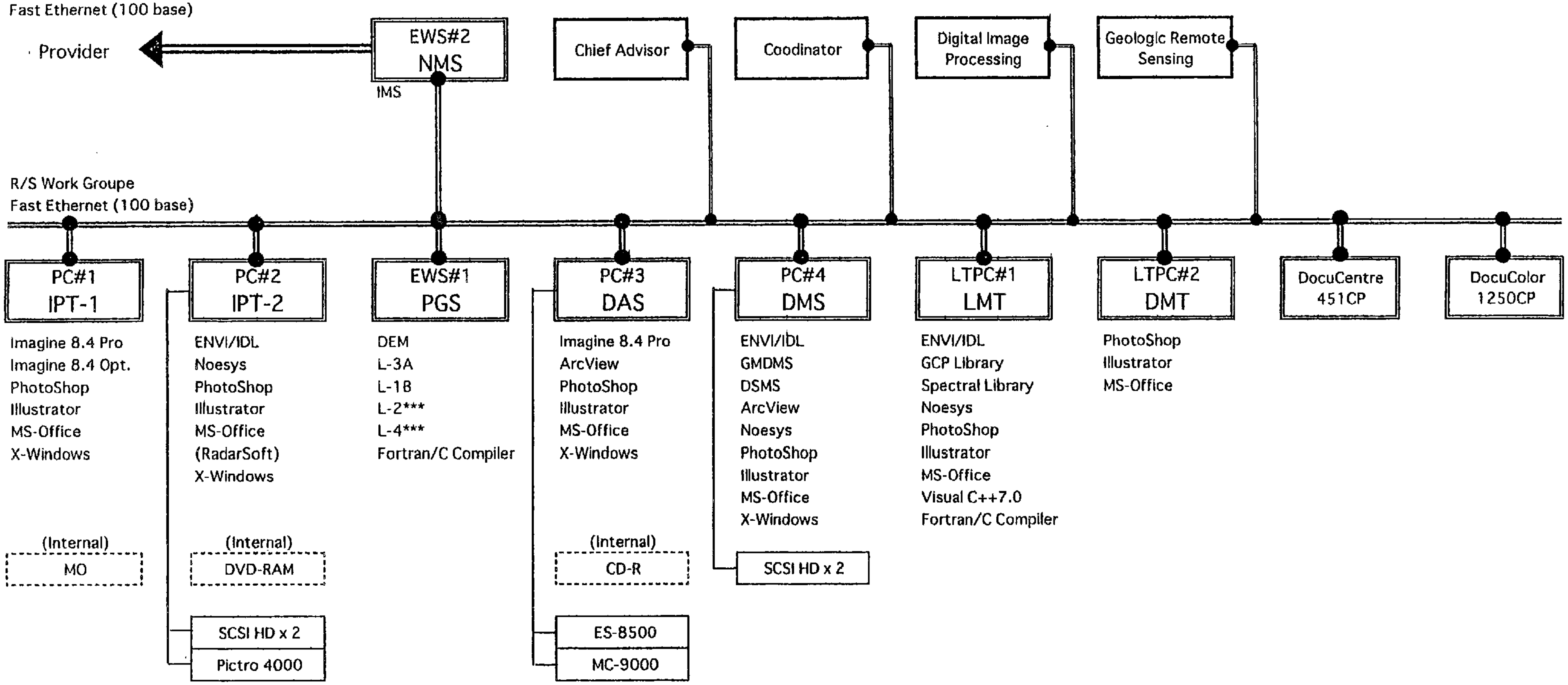
1. R/S Processing System

	Quantity	Specification			
Hardware					
EWS					
	1	4 CPU	450 MHz<	4 MB< Cache	SUN Ultra 80 Model 4450
		4 GB< RAM			
		Internal HDD	18 GB SCSI x 2		
		External HDD	18 GB SCSI x 12, RAID Array		SUN StorEdge A1000
		Graphics Board	Expert3D		
		21"CRT			
		8mm Tape Drive	(External)		
		12-24GB 4mm DDS-3 Tape Drive(internal)			
		CD-ROM	(Internal)	32x speed	
		DVD-ROM	(Internal)		
		100M Fast Ethernet			
		Keyboard			
		Mouse			
		CoProcessor			SunPCi
		OS			Solaris 7
		with Accessories			
		with Support			Silver Support
NETWORK Server	1	Sun Enterprise 220R A34-ULD1-512MFA1			
		12-24GB 4mm DDS-3 Tape Drive(internal)			
		with Setup			
		with Accessories			
Desktop PC					
	4	2 CPU	933 MHz<		HP Kayak XU800
		FSB	133 MHz<		
		512 MB< RAM			
		Internal HDD	18 GB SCSI x 2		
		Graphics Board			
		Video Memory	64 MB<		
		100Base-TX Lan Adapter			
		CD-ROM	48x speed		
		21"CRT			
		OS	Windows NT Workstation 4.0+SP6		
		Keyboard			
		Mouse			
		with Accessories			
		CPU Stand			
Desktop Accessories	1	CD-RAM Drive	(Internal)		
	1	DVD-RAM Drive	(Internal)		
	1	MO Drive	(Internal)		
	4	SCSI 18G HD	(External)		
FujiXerox	1	Network Printer			DocuCentre 451CP
FujiXerox	1	Network Color Printer & Scaner			DocuColor 1250CP

FujiXerox	1			+ Document Gate 2
Fuji Film	1	Color Photo Printer		Pictrogrphy 4000 120MB
				Pictro Rip
EPSON	1	Image Scaner		EPSON ES-8500
EPSON	1	InkJet Color Plotter		EPSON MC-9000SR
Note PC				
	2	1 CPU Movile Pentium III 850MHz<		SONY VAIO XR100F/K
		128 MB RAM		
		Internal HDD 30GB<		
		100Base-TX Lan Card		
		USB Mouse		
		USB Hub		
Power Supply				
	2	Uninterruptable	1KVA, 10minutes Backup	
Software				
ENVI/IDL	3	Ver.3.2+SP2		Image processing
Noesis	3	Ver.2.0		HDF Viewer
ERDAS	2	Imagene 8.4 professional		PC Version
ERDAS	1	Imagine 8.4	OrthoRadar	PC Version, for SAR
	1	Imagine 8.4	StereoSAR	PC Version, for SAR
	1	Imagine 8.4	IFSAR	PC Version, for SAR
(	1	Imagine 8.4	Vector	PC Version)
(	1	Imagine 8.4	VirtualGIS	PC Version)
(	1	Imagine 8.4	OlthoBASE	PC Version)
(	1	Imagine 8.4	ATCOR2	PC Version)
PCI	1	RadarSoft (Atlantis)		PC Version, for SAR
ArcView	2	Ver.3.2		GIS Viewer
	2	Image Analyst		GIS Viewer Tool
	2	Spatial Analyst		GIS Viewer Tool
Humming Bird	6	Exceed 7.0		X-Windows Emulator
Adobe	6	Photoshop 6.0		
	6	Illustlator 9.0		
Symantec	6	System Works 2000		
Micro Soft	6	Office 2000 Pro		
	1	Visual C++7.0		
Lahey	1	Fortran/C Compiler		
Sun	1	Forte C++ Personal Edition		Solaris Version
	1	Forte Fortran Desktop Edition		Solaris Version
ERSDAC	1	DEM Processor		EWS
	1	L-3A Processor		EWS
	1	L-1B Processor		EWS
	1	GMDMS		PC
	1	DSMS		PC
	1	IMS		EWS
	1	Spectral Library		PC
	1	GCP Library		PC

Plan for network of this R/S processing system is shown in the next page.

R/S Work Group System



NMS	Network Management System (Network Server)
PGS	Products Generating System (Data Server)
IPT	Image Processing Terminal
DAS	Data Analyzing System
DMS	Data Management System
LMT	Library Management Terminal
DMT	Document Management Terminal

2. Equipment for field survey

Item		Number
1	Field Portable Spectroradiometer	
	GER3700 Main Body, Tripod, Standard Battery Power Supply Cable, Battery Charger Cable AC Power Supply Cable, Manual	1
	PC(for data processing)	1
	Reflection Diffuser Plate	1
2	FT-IR Spectrometer	
	Model 102 Main Body, Tripod, Standard Battery Battery Checker, Power Suply Cable Battery Charger Cable 0.4 litter liquid nitrogen dewar-bottle Diffuse gold plate, Manual	1
3	GPS	
	GeoExplorer III (39100-00-ENG) (Trimble) External Power Kit External Antenna Kit RTCM/NMEA Data Splitter Cable	4
	Hard Carrying Case	4
	PC(for data processing)	2
	1 Yr Extended Warranty (hardware)	4

3. ASTER Data necessary for technology transfer

Category B

REMOTE SENSING AREA

Quantity	Description
2	PENTIUM COMPUTER DELL OptiPlex Pentium II 64 Mb RAM, 4 Gb SCSI HD Image Processing Platform PCI, ER-Mapper 5.2
1	KAYAK COMPUTER XM600 7/800 Pentium III 800 Mhz 256 Mb RAM, 9 Gb SCSI HD Image Processing Platform ERDAS Imagine 8.4 (NT)

GIS AREA

1. Digitizing and Edition Component

Quantity	Description
1	PENTIUM COMPUTER ACER 5200 Pentium 200 64 Mb 2Gb SCSI HD Windows NT 4 p3. ArcView 3.1. Microstation. X Windows Server Digitizer platform with Arc-Info EWS and Microstation. Attched scanning system (A0 Scanner connected)
2	PENTIUM COMPUTER DELL OptiPlex Pentium 200 32 Mb RAM, 1Gb SCSI HD Digitizing platform with Arc/Info NT
1	PENTIUM COMPUTER DELL OptiPlex Pentium 200 32 Mb RAM, 1Gb SCSI HD X Windows Digitizing platform width LINUX RED HAT 6.1
1	COMPAQ COMPUTER DESK PRO EP Pentium III 650 Mhz 256 Mb RAM 18 Gb SCSI HD X Windows Digitizing platform width LINUX RED HAT 6.1
3	DIGITIZER TABLE SUMAGRAPHICS IV

2. Server System

Quantity	Description
1	SUN Sparcstation 20, 128 Mb RAM, 8Mb HD MAIN ARC/INFO Aplication and Development System. Arc/Info Map Production Server. Arc/Info Digitizing Server. 3 Arc/Info Licenses

	Internal HTTP Server GIS Data Server
1	SUN Enterprise 250, 400 Mb RAM, 18Mb HD MAIN ARC/INFO Aplication and Development System. Arc/Info Map Production Server. Arc/Info Digitizing Server. 3 Arc/Info Licenses Internal HTTP Server GIS Data Server
1	ACER ALTOS 9000 COMPUTER Pentium PRO 256 Mb RAM, LINUX RED HAT OS 6.1, 4 Gb SCSI HD. MAIN FILE SERVER
1	PLOTTER A0 HP 755CM 74 Mb RAM Postscript printer Network supported

3. Others

Quantity	**Description**
1	COMPUTADORA PENTIUM DELL OptiPlex Pentium 200 64 Mb RAM, 1Gb SCSI HD Development and Data Administration platform with Arc/Info EWS, X Windows emulator, Arc/View 3.2.
1	PENTIUM COMPUTER DELL OptiPlex Pentium 200, 32 Mb, 1Gb SCSI HD. Administrative Computer. Windows NT 4 p3. Arc-View 3.1 (Graciela Marin computer)

Shareable Equipment

Quantity	**Description**
1	PLOTTER A0 HP 755CM 74 Mb RAM Postscript printer Network supported
1	LASER PRINTER HP 5M 8 Mb RAM Postscript printer Network supported
1	A0 SCSI Scanner B/W 800 dpi max.
1	PENTIUM COMPUTER ACER ALTOS 300 Pentium 200, 32 Mb, 1Gb SCSI HD. LINUX RED HAT 6.1 OS UNIX Aplication Development Server

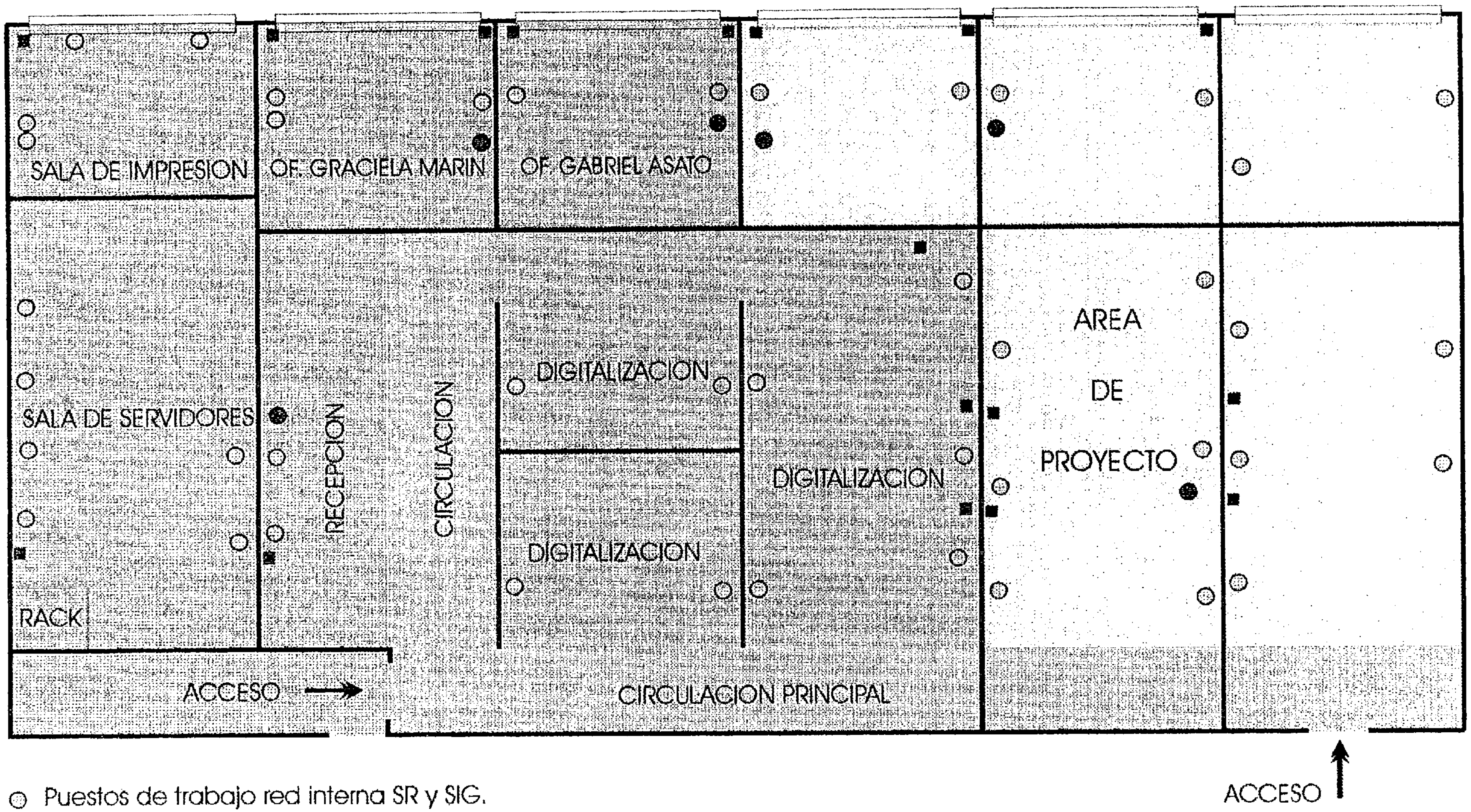
	FGDC Metadata Server Internal HTTP Server
1	Five 2x CDROM SCSI Tower, width HP 4x CD ROM recorder
1	HEXABYTE 870 LT (under UNIX)
When necessity arises	Equipment for Workshops and Seminars (copy machine, LCD projector etc.)

FOR FIELD SURVEY

When necessity arises	Vehicles
When necessity arises	Equipments for field survey (rock hammer, portable-GPS etc.

ANNEX 7

Layout of the present building and rooms



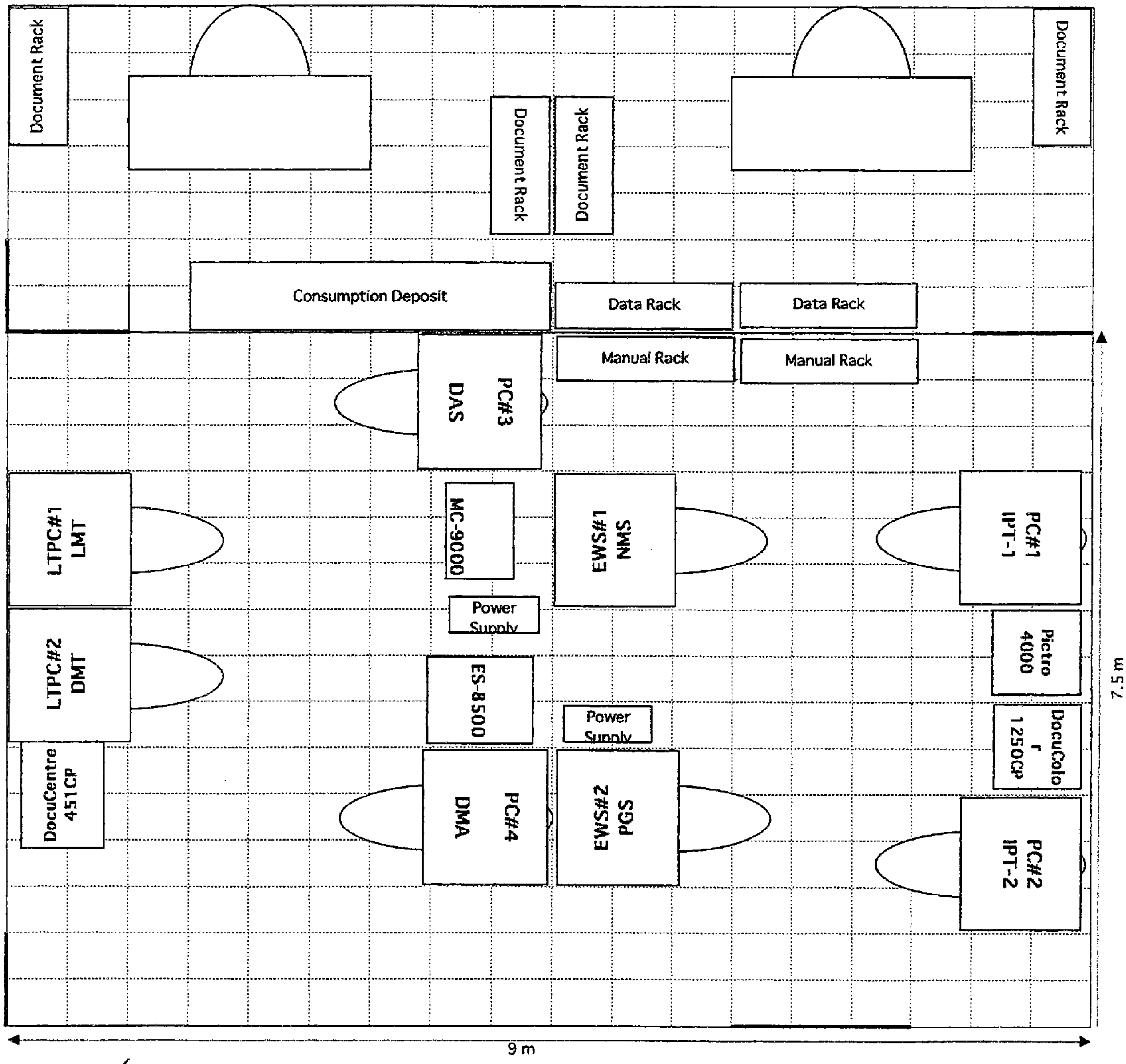
○ Puestos de trabajo red interna SR y SIG.

● Puestos de trabajo red externa.

■ Red telefónica alternativa.

Unidad Sensores Remotos y SIG
Piso 8 sectores 30, 1, 2, 3 y 4.

Provisional layout of necessary facilities and equipment ANNEX 8



ANNEX 9

List of full-time and part-time counterpart

1. Coordinators

Name	Position
Graciela Marín	Acting Director of the RS&GIS Division
Antonio Lizuain	Director of Regional Geology Direction (DGR)
Eduardo Zappettini	Director of Geological and Mining Resources Direction (DRGM)
Omar R. Lapido	Director of Environmental and Applied Geology Direction

2. RS and GIS Division Staff

	Present Activity	Project Activity
Carlos Gabriel Asato - Geologist, specialized in RS and GIS (1991).	Corporate GIS administrator, GIS and integration data projects developer.	GIS Administrator, GIS developer, RS process participation.
RS Project Staff – Full Time		
Inés Di Tommaso – Geologist (1979) and GIS operator (1996).	GIS digitizer.	RS process and interpretation.
Silvia Castro Godoy – Geologist (1993) and GIS operator (1996).	GIS digitizer.	RS process and interpretation.
Diego Azcurra – Geologist (2000) specialized in RS (1997).	RS processing.	RS process and interpretation.
Cintia Marquetti – Geologist 2000).	RS processing.	RS process and interpretation.
RS Project Staff – Part Time		
Rosana Isabel Matuk Herrera – Computer Analyst (2000).	RS&GIS network administrator	RS&GIS network administrator.
Nestor Alsina – Mathematician (1977), specialized in RS and GIS.	RS processing.	RS process participation.
Damian Bonnano – Technician (1998) in RS (1999).	RS processing.	RS process participation.
GIS Staff		
Jorge Romano – Geologist (1992) specialized in computer systems.	Arc/Info programming. Digital map production administrator.	
Silvia Chavez – Geologist (2000) and GIS operator (1996).	GIS digitizer.	
Veronica Molina – Math-Topographic Technician (1992) and GIS operator (1996).	GIS digitizer.	
Norberto Gabriel Candaosa - Math-Topographic Technician (1997) and GIS operator (1997).	GIS digitizer.	
María Liliana Gambandé Alvarez – Geographer (1994) and GIS operator (1998).	GIS digitizer.	
Ana Felisa Tavitian Serrano - Math-Topographic Technician (1994) and GIS operator (1996).	GIS digitizer.	
María Isabel Olmos – Geographer (1990) and GIS operator.	GIS digitizer.	

3. Part-time counterpart from other sections

Sections	No of staff
Regional Geology Direction (DGR)	20 geologists
Geological and Mining Resources Direction (DRGM)	8 geologists
Environmental and Applied Geology Direction (DGAA)	4 geologists

ANNEX 10

BUDGETARY PLAN OF THE COST NECESSARY FOR OPERATION OF THE PROJECT WHICH IS TO BE BORNE BY THE ARGENTINE SIDE

Item Description	**Budget 2001**	**Budget 2002**	**Budget 2003**	**Budget 2004**	**Budget 2005** (Jan-Mar/00)	
Software maintenance / up grade	8000	8000	12000	12000	2000	
Hardware maintenance	7000	7000	8500	8500	500	
Consumables (paper, ink, toner, CD, other)	5000	5000	6500	6500	500	
ASTER data delivery (transportation, and consumables from Japan to Argentina)	5000	5000	5000	5000	1000	
Air tickets / transportation	4000	4000	4000	4000	1000	
Field Allowances	56000	56000	62000	62000	5000	
Field Operative Costs (assistants, oil, truck maintenance, library, photography, others)	15500	15500	15500	15500	2000	
Samples Chemical Analyzes		4000	5600	5600	1500	
K-AR / U-PBS Age Determination		10000	14000	14000	3000	
Petrography Slide Sections		3800	5200	5200	1500	
Seminar/Workshop	2000	2000	2000	2000		
Part time Data Entry	5000	7200	7200	7200	2000	
Total:	**107500**	**127500**	**147500**	**147500**	**20000**	**550000**

Remarks:

- **Geological and metalogenetic maps**: During the project, 4 geological maps (1:100.000) and 1 metalogenetic map (1:250.000) will start by year. Eighteen (18) months will be necessary to finish each one, so at the end of the project, 8 geological and 2 metalogenetic maps will be finished; also 4 geological and 1 metalogenetic maps will be started.

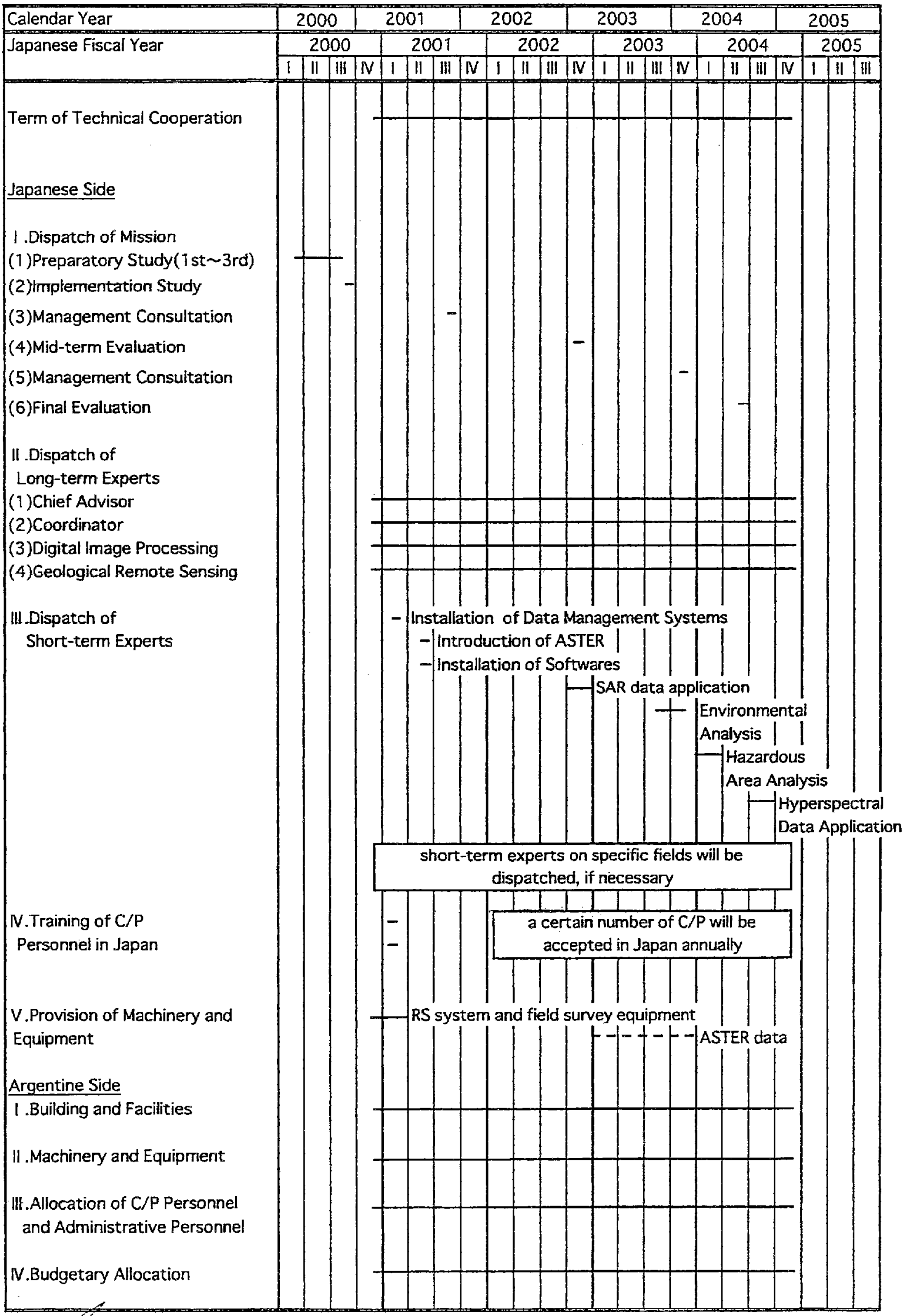
- **X-ray analysis**: The X-ray analysis will be done in the laboratories of INTEMIN.

- **Vehicles**: The vehicles of SEGEMAR will be used for field survey. It should be necessary to request them 6 months before the scheduled use. Nevertheless extraordinary needs will be attended according to the circumstances.

- **Seminars**: Four seminar(s)/workshop(s) by year will be developed in order to show the new technology to all the professionals into SEGEMAR, universities, national and provincial organizations, companies and consultants. Two of the seminar(s)/workshop(s) will be held in Buenos Aires, and the other two will be held in the Provinces.

ANNEX 11

Tentative Schedule of Implementation (TSI)



NOTE:Japanese fiscal year starts in April and ends in March.

2000.12.21

Plan of Operations for the whole period

OUTPUT	ACTIVITY	Calendar Year	2001				2002				2003				2004							REMARKS
		JFY	2000	2001				2002				2003				2004				in charge		
		TARGET	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	Japan	Argentina	
A1.System for utilizind satellite data is established.	1-1 Allocate staff as planned		▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	CA	P/M	
	1-2 Make the plan of operations		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	CA	P/M	
	1-3 Make the budgetary plans		▬	▬		▬	▬	▬		▬	▬	▬		▬	▬	▬		▬	▬	CA	P/M	
	1-4 Make and implement the monitoring and evaluation plan		▬	▬	▬		▬		▬		▬		▬		▬		▬		▬	CA	P/M	
	1-5 Operate the joint coordinating committee		▬				▬				▬				▬				▬	CA	P/M	
A2.Equipment and satellite data are managed and maintained properly.	2-1 Make and implement equipment operation and maintenance plan		▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	Expert both	RS/GIS DRG	
	2-2 Establish and operate data management systems		▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	Expert Image P.	RS/GIS	
	2-3 Procure and install necessary equipment		▬	▬																Expert both	RS/GIS DGR	
	2-4 Allocate budget for operation and maintenance of the equipment		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	CA	RS/GIS DGR	
	2-5 Teach C/Ps how to operate and maintain of the equipment		▬	▬	▬	▬	▬													Expert both	RS/GIS DGR	
A3. IGRM geologists have enough technology to utilize advanced satellite data such as ASTER and/or PALSAR on geological and thematic mapping for mineral exploration.	3-1 Training for hard ware and soft ware		▪	▪	▪															Expert Image P.	RS/GIS	
	3-2 Introduce interpretation examples by using ASTER simulation data		▪	▪	▪															Expert Geology	RS/GIS DGR,DGRM	
	3-3 Teach C/Ps how to process ASTER data					▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Expert Image P.	RS/GIS	
	3-4 Teach C/Ps how to utilize ASTER DEM							▬	▬											Expert Geology	RS/GIS DGR	
	3-5 Teach C/Ps how to make alteration mineral maps and lithologic maps by silica content					▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	Expert Geology	RS/GIS DGR,DGRM	
	3-6 Teach C/Ps how to conduct field survey for alteration mineral mapping and lithologic mapping by silica content					▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	▬	Expert Geology	DGR DGRM	
	3-7 Teach C/Ps how to perform integrated geological interpretation by ASTER data											▬	▬	▬	▬	▬	▬	▬	▬	Expert Geology	IGRM	
	3-8 Teach C/Ps how to analyze PALSAR data									▬	▬									Short T.Expert	RS/GIS	
	3-9 Teach C/Ps how to analyze Hyperspectral data																	▬	▬	Short T.Expert	RS/GIS	
A4. Usefulness of the remote sensing technology is understood by the persons concerned and users through seminars and workshops.	4-1 Hold seminars and workshops				▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	CA	P/M	
B.3 IGRM geologists understand how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental or hazardous area study.	1.Teach C/Ps how to conduct environmental analysis by ASTER and/or PALSAR data												▬							Short T.Expert	RS/GIS OGAA	
	2.Teach C/Ps how to conduct hazardous area analysis using ASTER and/or PALSAR												▬							Short T.Expert	RS/GIS UGAA	
	3.Teach C/Ps how to conduct field survey to verify the results of environmental and hazardous area analysis												▬							Short T.Expert	OGAA	

NOTE:The Japanese fiscal year starts in April and ends in March.

ANNEX 12

2000.12.21

Annual Plan of Operations for the Year 2001

Output	Activity	Target	2000	(JFY)2001												in charge		Remarks
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Japan	Argentine	
A1.System for utilizind satellite data is established.	1-1 Allocate staff as planned		■	■	■	■	■	■	■	■	■	■	■	■	■	CA	P/M	
	1-2 Make the plan of operations		■	■	■	■	■	■	■	■	■	■	■	■	■	CA	P/M	
	1-2-1 Make the plan of operations for whole period		■	■												CA	P/M	
	1-2-2 Make the annual plan of operations for JFY 2001		■	■												CA	P/M	
	1-2-3 Make the annual plan of operations for JFY 2002								■	■	■	■	■	■		CA	P/M	
	1-3 Make the budgetary plans		■	■	■	■	■	■	■	■	■	■	■	■	■	CA	P/M	
	1-3-1 Make the budgetary plan for whole period		■	■												CA	P/M	
	1-3-2 Make the budgetary for JFY 2001		■	■												CA	P/M	
	1-3-3 Make the budgetary for JFY 2002								■	■	■	■	■	■		CA	P/M	
	1 -4 Make and implement the monitoring and evaluation plan		■	■	■	■	■	■	■					■	■	CA	P/M	
	1-4-1Make the monitoring and evaluation plan		■	■	■	■	■	■	■							CA	P/M	
	1-4-2 Make the monitoring report of JFY 2001													■	■	CA	P/M	
	1-5 Operate the joint coordinating committee		■												■	CA	P/M	

ANNEX 13

2000.12.21

Annual Plan of Operations for the Year 2001

Output	Activity	Target	2000	(JFY)2001												in charge		Remarks
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Japan	Argentine	
A2.Equipment and satellite data are managed and maintained properly.	2-1 Make and implement equipment operation and maintenance plan		■	■	■	■	■	■	■	■	■	■	■	■	■	Expert I.P.and G.	RS/GIS DGR	
	2-1-1 Make equipment management plan		■	■	■											CA	RS/GIS DGR	
	2-1-2 Implement equipment management plan					■	■	■	■	■	■	■	■	■	■	CA	RS/GIS DGR	
	2-2 Establish and operate data management systems		■	■	■	■	■	■	■	■	■	■	■	■	■	EXPERT IMAGE P.	RS/GIS	
	2-2-1 Establish of data search and DGR system for ASTER		■	■	■	■										EXPERT IMAGE P.	RS/GIS	
	2-2-2 Operation of data search and DGR system for ASTER						■	■	■	■	■	■	■	■	■	EXPERT IMAGE P.	RS/GIS	
	2-2-3 Establish of data management system for ASTER		■	■	■	■										EXPERT IMAGE P.	RS/GIS	
	2-2-4 Operate of data management system for ASTER						■	■	■	■	■	■	■	■	■	EXPERT IMAGE P.	RS/GIS	
	2-2-5 Plan ASTER data set processing policies		■	■	■	■	■	■	■	■	■	■	■	■	■	EXPERT IMAGE P.	RS/GIS	
	2-2-6 Establish ASTER data set processing system															EXPERT IMAGE P.	RS/GIS	
	2-2-7 Operate of ASTER data set processing system															EXPERT IMAGE P.	RS/GIS	
	2-2-8 Establish of ASTER data set archive and distribution system															EXPERT IMAGE P.	RS/GIS	
	2-2-9 Operate ASTER data set archive and distribution system															EXPERT IMAGE P.	RS/GIS	
	2-3 Procure and install necessary equipment		■	■	■	■										Expert I.P.and G.	RS/GIS DGR	
	2-4 Allocate budget for operation and maintenance of equipment		■	■	■	■	■	■	■	■	■	■	■	■	■	CA	RS/GIS DGR	
	2-4-1 Estimate cost for operation and maintenance equipment budget		■	■	■											CA	RS/GIS DGR	
	2-4-2 Estimate frequency of consumable supply				■	■	■	■								CA	RS/GIS DGR	
	2-4-3 Make the budget plan for equipment operation and maintenance consumable supply						■	■	■	■	■	■	■	■	■	CA	RS/GIS DGR	
	2-5 Teach C/Ps how to operate and maintain of the equipment			■	■	■	■	■	■	■	■	■	■	■	■	Expert I.P.and G.	RS/GIS DGR	

Annual Plan of Operations for the Year 2001

2000.12.21

Output	Activity	Target	2000	(JFY)2001												in charge		Remarks
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Japan	Argentine	
A3. IGRM geologists have enough technology to utilize advanced satellite data such as ASTER and/or PALSAR on geological and thematic mapping for mineral exploration.	3-1 Training for hardware and software			■	■	■	■	■	■							EXPERT IMAGE P.	RS/GIS	
	3-1-1 Set-up for Image Processing System (H/W)			■												EXPERT IMAGE P.	RS/GIS	Incluit OS
	3-1-2 Training for Image Processing System (H/W) Operation				■	■										EXPERT IMAGE P.	RS/GIS	IncluitOS
	3-1-3 Installation of Image Processing System (S/W)			■												EXPERT IMAGE P.	RS/GIS	ENVI, Noesys, PhotoShop etc.
	3-1-4 Training for Image Processing System (S/W) Operation				■	■	■	■	■							EXPERT IMAGE P.	RS/GIS	ENVI, Noesys, PhotoShop etc.
	3-1-5 Installation of ArcView			■												EXPERT IMAGE P.	RS/GIS	
	3-1-6 Training for ArcView				■	■	■	■	■							EXPERT IMAGE P.	RS/GIS	
	3-1-7 Installation of ERDAS Imagine 8.4			■												EXPERT IMAGE P.	RS/GIS	
	3-1-8 Training for ERDAS Imagine 8.4			■	■	■	■									EXPERT IMAGE P.	RS/GIS	
	3-1-9 Installation of RadarSoft															EXPERT IMAGE P.	RS/GIS	JFY2003
	3-1-10 Training for RadarSoft															EXPERT IMAGE P.	RS/GIS	JFY2003
	3-1-11 Training for HyperSpector															EXPERT IMAGE P.	RS/GIS	JFY2004
	3-2 Introduce interpretation examples by using ASTER simulation data		■	■	■	■	■									EXPERT GEOLOGY	RS/GIS DGR,DGRM	
	3-2-1 ASTER data characteristics		■	■												EXPERT GEOLOGY	RS/GIS DGR,DGRM	
	3-2-2 An example of mineral discrimination technique				■	■	■									EXPERT GEOLOGY	RS/GIS DGR,DGRM	
	3-2-3 Spectral characteristics of alteration mineral of Porphyry Copper Deposits		■	■												EXPERT GEOLOGY	RS/GIS DGR,DGRM	
	3-2-4 Spectral characteristics of other deposits				■	■	■									EXPERT GEOLOGY	RS/GIS DGR,DGRM	
	3-3 Teach C/Ps how to process ASTER data							■	■	■	■	■	■	■	■	EXPERT IMAGE P.	RS/GIS	
	3-3-1 Understanding of ASTER specification						■	■	■							EXPERT IMAGE P.	RS/GIS	
	3-3-2 Understanding of ASTER Format						■	■	■							EXPERT IMAGE P.	RS/GIS	
	3-3-3 Reformatting ASTER data							■	■							EXPERT IMAGE P.	RS/GIS	Radiometric & Geometric

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Annual Plan of Operations for the Year 2001

Output	Activity	Target	2000	(JFY)2001												in charge		Remarks
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Japan	Argentine	
	3-3-4 ASTER bands operation						▬	▬	▬							EXPERT IMAGE P.	RS/GIS	
	3-3-5 ASTER DEM processing						▬	▬	▬							EXPERT IMAGE P.	RS/GIS	
	3-3-6 ASTER L-3A processing															EXPERT IMAGE P.	RS/GIS	JFY2002
	3-3-7 ASTER L-2 processing															EXPERT IMAGE P.	RS/GIS	JFY2002
	3-3-8 ASTER L-4 processing															EXPERT IMAGE P.	RS/GIS	JFY2002
	3-3-9 ASTER L-3C processing															EXPERT IMAGE P.	RS/GIS	JFY2002
	3-3-10 Mosaicing and framing for ASTER data															EXPERT IMAGE P.	RS/GIS	JFY2002
	3-3-11 Mosaicing and framing for ASTER data set															EXPERT IMAGE P.	RS/GIS	JFY2003
	3-3-12 ASTER data set processing for GIS															EXPERT IMAGE P.	RS/GIS	JFY2003
	3-4 Teach C/Ps how to utilize ASTER DEM															EXPERT GEOLOGY	DGR	JFY2002
	3-5 Teach C/Ps how to make alteration mineral maps ahd lithologic maps by silica content									▬	▬	▬	▬	▬	▬	EXPERT GEOLOGY	DGR	
	3-5-1 Spectral characteristics of altered minerals							▬								SHORT- T.EXPERT	DGR	
	3-5-2 Prediction algorithm for altered minerals and silica contents							▬	▬	▬						SHORT- T.EXPERT	DGR	
	3-5-3 Discrimination technique by ASTER data										▬	▬	▬	▬		SHORT- T.EXPERT	DGR	
	3-6 Teach C/Ps how to conduct field survey for alteration mineral mapping and lithologic mapping by silica content									▬	▬	▬	▬	▬	▬	EXPERT GEOLOGY	DGR,DGRM	
	3-6-1 Portable spectrometer training									▬	▬	▬				SHORT- T.EXPERT	DGR,DGRM	
	3-6-2 Field data archive									▬	▬	▬	▬	▬	▬	SHORT- T.EXPERT	DGR,DGRM	
	3-7 Teach C/Ps how to perform integrated geological interpretation by ASTER data															EXPERT GEOLOGY	IGRM	JFY2003
	3-8 Teach C/Ps how to analyze PALSAR data															SHORT- T.EXPERT	RS/GIS IGRM	JFY2003
	3-9 Teach C/Ps how to analyze Hyperspectral data															SHORT- T.EXPERT	RS/GIS IGRM	JFY2003

Annual Plan of Operations for the Year 2001

2000.12.21

Output	Activity	Target	2000	(JFY)2001												In charge		Remarks
			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Japan	Argentine	
A4. Usefulness of the remote sensing technology Is understood by the persons concerned and users through seminars and workshops.	4-1 Hold seminars and workshops							━								CA	P/M	
B.3 IGRM geologists understand how to utilize advanced satellite data such as ASTER and/or PALSAR lin environmental or hazardous area study.	1. Teach C/Ps how to conduct hazardous area analysis using ASTER and/or PALSAR															Short T.Expert	RS/GIS DGAA	
	2.Teach C/Ps how to conduct hazardous area analysis using ASTER and/or PALSAR															Short T.Expert	RS/GIS DGAA	
	3. Teach C/Ps how to conduct field survey to verify the results of environmental and hazardous area analysis															Short T.Expert	DGAA	

Project Design Matrix (Ver. 1)

ANNEX 14

Project Name: Regional Geological Mapping with Advanced Satellite Data in the Argentine Republic
Duration of the Project: From March 1, 2001 to February 28, 2005
Prepared by: Both sides after discussion based on the draft of the Japanese side

Implementing Agency:
-Argentine Geological and Mining Survey (SEGEMAR)
-Japan International Cooperation Agency (JICA)

Target Area: The whole country of the Argentine Republic
Target Group: Geologists who are engaged in thematic mapping with remote sensing in SEGEMAR

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
(Super Goal A) Geological maps and thematic maps prepared by IGRM are utilized by mining investors in Argentine.			
(Overall Goal A) Geological maps and thematic maps for mineral exploration using advanced satellite data are prepared by IGRM.	1. The area covered by the geological maps and thematic maps is expanded. 2. The types of the thematic map increase. 3. Users (other government organizations and private companies) are able to access the thematic maps easily.	1. Number of the geological maps and thematic maps made 2. Types of the thematic map made 3. Questionnaires to the users	a. Prices of metals do not decrease drastically. b. Administrative measures necessary for promoting mining investments (e.g. improvement of the mining rights management system) are carried out.
(Project Purpose A) IGRM is able to utilize advanced satellite data such as ASTER and/or PALSAR in order to make geological maps and thematic maps for mineral exploration.	1. 8 sheets of 1:100,000 geological maps and 2 sheets of metallogenic maps are made using ASTER and/or PALSAR data. 2. Quality of geological maps and thematic maps are improved by using ASTER and/or PALSAR data. 3. Efficiency of geological mapping and thematic mapping are increased by using ASTER and/or PALSAR data.	1. Number of geological maps and thematic maps made 2-1. Evaluation by Japanese experts 2-2. Evaluation by Evaluation Committee 2-3. Questionnaires to geologists of DGR and DRGM 3-1. Evaluation by Japanese experts 3-2. Evaluation by Evaluation Committee 3-3. Questionnaires to geologists of DGR and DRGM	a. Personnel and budget are allocated to continue operations for thematic mapping after the Project ends. b. System for distributing the thematic maps is established.
(Output A) 1. System for utilizing satellite data is established. 2. Equipment and advanced satellite data are managed and maintained properly. 3. IGRM geologists have enough technology to utilize advanced satellite data such as ASTER and/or PALSAR on geological and thematic mapping for mineral exploration. 4. Usefulness of the remote sensing data is understood by the persons concerned and users through seminars and workshops.	1-1. Enough C/Ps of adequate qualification are allocated. 1-2. Enough budget is allocated and disbursed properly. 2-1. Operation and maintenance plan for equipment and satellite data is made and implemented. 2-2. Enough budget for operating and maintaining the equipment and the satellite data is allocated and disbursed. 2-3. Enough knowledge on operating and maintaining the equipment is acquired by the C/Ps. 3. I~IV, VII of the fields of technology transfer are acquired by the C/Ps concerned. 4-1. Many persons concerned and users participate in the seminars and workshops. 4-2. Usefulness of remote sensing data is understood by the participants in the seminars and workshops.	1. Records and plans of inputs 2-1. Operation and maintenance plan for equipment 2-2. Budget plan and record of disbursement for operating and maintaining the equipment 2-3. Monitoring sheet for technology transfer 3. Monitoring sheet for technology transfer 4-1. Number of participants in the seminars and workshops 4-2. Questionnaires to the participants in the seminars and workshops	a. C/Ps continue to work at IGRM.
(Activities)	Inputs		
	Japanese side	Argentine side	
1-1 Allocate staff as planned 1-2 Make the plan of operations 1-3 Make the budgetary plans 1-4 Make and implement the monitoring and evaluation plan 1-5 Operate the joint coordinating committee 2-1 Make and implement equipment operation and maintenance plan 2-2 Establish and operate data management systems 2-3 Procure and install necessary equipment 2-4 Allocate budget for operation and maintenance of the equipment 2-5 Teach C/Ps how to operate and maintain the equipment 3-1. Training for hardware and software 3-2. Introduce interpretation examples by using ASTER simulation data 3-3. Teach C/Ps how to process ASTER data 3-4. Teach C/Ps how to use DEM data 3-5. Teach C/Ps how to make alteration mineral maps and lithological maps by silica content 3-6. Teach C/Ps how to conduct field surveys for alteration minerals mapping and lithological mapping by silica content 3-7. Teach C/Ps how to perform integrated geological interpretation using ASTER data 3-8. Teach C/Ps how to analyze PALSAR data 3-9. Teach C/Ps how to analyze hyperspectral data 4-1 Hold seminars and workshops	a. Dispatch of Experts (Long-term) -Chief advisor -Coordinator -Digital image processing -Geological remote sensing (Short-term) -Installation of DEM software -Introduction of ASTER -Installation of data management system -PALSAR data analysis -Hyperspectral analysis b. Training of C/P in Japan c. Provision of Equipment -RS data processing system -Field survey equipment -ASTER data	a. Buildings and Facilities b. Allocation of C/P c. Preparation of Equipment d. Local Costs	Pre-conditions

Project Design Matrix (Ver. 1)

ANNEX 1

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
(Overall Goal B) Thematic maps for environmental conservation and hazard prevention are prepared by IGRM.	1. The area covered by the thematic maps is expanded. 2. The types of the thematic map increases. 3. Users (other government organizations) are able to access the thematic maps easily.	1. Number of the thematic maps made 2. Types of thematic map made 3. Questionnaires to the users	
(Project Purpose B) IGRM understands how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental or hazardous area study.	1. V and VI of the fields of technology transfer are acquired by the C/Ps concerned.	1. Monitoring sheet for technology transfer	a. C/Ps acquire the method of thematic mapping with field verification. b. Personnel and budget are allocated to continue operations for thematic mapping after the Project ends. c. System for distributing the thematic maps is established.
(Output B) 1. System for utilizing satellite data is established. 2. Equipment and advanced satellite data are managed and maintained properly. 3. IGRM geologists understand how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental or hazardous area study.	1. (Same as Output A) 2. (Same as Output A) 3. (Same as Project Purpose B)		

(Activities)	Inputs		
	Japanese side	Argentine side	
3-1. Teach C/Ps how to conduct environmental analysis by ASTER and/or PALSAR data 3-2. Teach C/Ps how to conduct hazardous area analysis by ASTER and/or PALSAR data 3-3. Teach C/Ps how to conduct field survey to verify the results of environmental and hazardous area analysis	a. Dispatch of Experts (Long-term) -Chief advisor -Coordinator -Digital image processing -Geological remote sensing (Short-term) -Environmental analysis -Hazardous area analysis c. Training of C/P in Japan d. Provision of Equipment -RS data processing system -Field survey equipment -ASTER data	a. Buildings and Facilities b. Allocation of C/P c. Preparation of Equipment d. Local Costs	Pre-conditions

ANNEX 15

MONITORING AND EVALUATION PLAN (Draft)

November 7, 2000

0. Outline of the Project

Name of the Project	Regional Geological Mapping with Advanced Satellite Data in the Argentine Republic
Term of Cooperation	From March 1, 2001 to February 28, 2005
Responsible Person	Argentine P.M, Japanese CA

I. Plan of the Project

1. Project Design Matrix (PDM)

-The PDM was formulated by the Japanese Implementation Study Team in consultation with the Argentine side on(Annex ****)

2. Plan of Operations (PO)

-The PO was formulated by the Japanese Implementation Study Team in consultation with the Argentine side on(Annex ****)

-The PO will be reviewed annually in March by the Project Team and revised if necessity arises.

-The APO for the next Japanese Fiscal Year will be settled on annually in March by the Project Team (Annex****).

II. Operation System of Monitoring and Evaluation

1. Monitoring

(1) Semi Annual Monitoring

-This will be implemented quarterly by the Japanese long term expert and Coordinators(Project team) in order to monitor the progress of the activities along with the PO.

(2) Annual Monitoring

-This will be implemented semiannually(March and September) by the Project team in order to monitor the progress of the activities along with the PO and the achievement of the outputs along with PDM indicators. The summarized results will be distributed to the organizations and/or personnels concerned with the Project.

-The result of the monitoring by the Project team will be confirmed by the Japanese Management Consultation team and Joint Coodinating Committee in March.

2. Evaluation

(1) Mid-Term Evaluation

-This will be conducted by the Project Team, Japanese Management Consultation Team and Joint Coordinating Committee (JCC) in the middle of the cooperation period of the Project in order to mid-term-evaluate the five (5) basic evaluation components.

(2) Pre-Evaluation

-This will be conducted by the Project Team two (2) or three (3) months before the Final Evaluation in order to pre-evaluate the five (5) basic evaluation components.

(3) Final Evaluation

-This will be conducted jointly by both sides approximately six (6) months before the termination of the cooperation period of the Project by the both Governments through JICA and SEGEMAR in order to examine the level of achivement of the master plan of the Projects as stipulated in the Records of Discussion (R/D) in December 2000.

III. Tentative Schedule for Monitoring and Evaluation

Time	Kinds of Monitoring/Evaluation	Organizations In Charge	Methods
by September 2001	Establishing monitoring plan and system	Project Team	Monitor the progress of the activities along with the PO
September 2001	Semiannual Monitoring		Monitor the progress of the activities along with the PO
March 2002	Annual Monitoring	Project Team Japanese Management Consultation Team Joint Coordinating Committee	Monitor the progress of the activities along with the PO Monitor the achievement of the outputs along with PDM indicators
September 2002	Semiannual Monitoring	Project Team	Monitor the progress of the activities along with the PO Monitor the achievement of the outputs along with PDM indicators
March 2003	Annual Monitoring Mid-term Evaluation	Project Team Japanese Management Consultation Team Join Coordinating Committee	Monitor the progress of the activities along with the PO Monitor the achievement of the outputs along with PDM indicators Analyze with five(5) Basic Evaluation Components
September 2003	Semiannual Monitoring	Project Team	Monitor the progress of the activities along with the PO
March 2004	Annual Monitoring	Project Team Japanese Management Consultation Team Joint Coordinating Committee	Monitor the progress of the activities along with the PO Monitor the achievement of the outputs along with PDM indicators
June 2004	Pre-Evaluation	Project Team	Analyze with five(5) Basic Evaluation Components
September 2004	Final Evaluation	Both Governments	Analyze with five(5) Basic Evaluation Components

IV. Subjects of Monitoring and Evaluation

1. Monitoring

-The subjects of Monitoring are explained in Annex****

2. Evaluation

-The subjects of evaluation are explained in Annex ****

<<MONITORING & EVALUATION SHEET - Provisional>>

1. Date of Monitoring (Quarterly/Semi-Annual/Annual)

2. Person(s) Who Carryied Out Monitoring (Name, Official Title, Qualification)

3. Results I (Themes and Subjects of Technology Transfer)

Theme & Subject	Proceeding										Achievement									
	C/P A	C/P B	C/P C	C/P D	C/P E	C/P F	C/P G	C/P H	C/P I	C/P J	C/P A	C/P B	C/P C	C/P D	C/P E	C/P F	C/P G	C/P H	C/P I	C/P J
1. Introductory training for hardware and software to make geological maps and thematic maps using advanced satellite data such as ASTER and/or PALSAR																				
2. Introduction on interpretation examples using ASTER simulation data																				
3. ASTER data processing																				
4. Utilization of ASTER DEM																				
5. Alteration mapping and silica content mapping by ASTER data																				
6. Field verification survey for alteration mapping and silica content mapping																				
7. Integrated geological interpretation by ASTER data																				
8. PALSAR data analysis																				
9. Introduction on hyperspectral data analysis																				
10. Introduction on environmental analysis using ASTER and/or PALSAR																				
11. Introduction on hazardous area analysis using ASTER and/or PALSAR																				
12. Instruction on field survey for environmental/hazardous area mapping																				
13																				
14																				
15																				
16																				
17																				
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26																				
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28																				
29																				
30																				

31. Alteration mineral maps and lithologic maps with silica content of quality are made		
32. Environmental and hazardous area analysis maps are acquired		

4. Results II (Technology Tranfer Systems and Organizations)

System & Organization	Proceeding	Achievement
1. Staff allocation as planned		
2. Expert allocation as planned		
3. Make the plan of operation		
4. Establishment on budgetary plan		
5. Implementation of the monitoring and evaluation plan		
6. Operation the joint coordinating committee		
7. Implementation of equipment operation and maintenance plan		
8. Establishment on data management systems		
9. Procurement and installation of necessary equipment		
10. Allocation of budget for operation and maintenance of equipment		
11. Instruction on operation and maintenance of equipment		
12. Holding for seminars and workshops		

5. Summary and Comments

1. Summary of This Term (1. Expansion of areas covered by the thematic maps, 2. Increase in the sort of thematic maps, 3. Users (government organizations and private companies) being able to access the thematic maps easily):

2. Comments:

3. Joint Coodinating Committee Comments:

Five (5) Basic Evaluation Components

1. Five (5) Basic Evaluation Components

The five basic components defined by JICA as mentioned below are in line with those used for the evaluation works by DAC and other international assistance organization. Introduction of these components has enabled a consistent, well-balanced evaluation, which minimizes evaluator bias. Further, it allows us to share the results, knowledge and lessons with other aid organizations, since we are using common components and can discuss with them from the same viewpoints.

(1) Efficiency

Evaluate the method, procedure, term and cost of the project with a view to productivity.

(2) Effectiveness

Evaluate the results in comparison with the goals (or revised ones) defined at the initial or intermediate stage, and evaluate the attributes (factors and conditions) of the results.

(3) Impact

Evaluate the positive and negative effects of the project, extent of the effect and beneficiaries.

(4) Relevance

Preliminary evaluate whether the needs in the country have been correctly identified, and whether the design is consistent with the national and/or master plan.

(5) Sustainability

Evaluate the autonomy and sustainability of the project after the termination of cooperation, from the perspectives of operation, management, economy, finance and technology.

2. Relation between Five Basic Components and PDM

The following five components are used for the evaluation and a selection of a project.

(1) Efficiency
(2) Effectiveness
(3) Impact
(4) Relevance
(5) Sustainability

These components are directly connected to the elements of PDM as shown in the Figure in the following page.

The component "Efficiency" is a measure to qualitatively and quantitatively compare all resource (input) to the results (output) of the project in order to evaluate the economic efficiency or conversion from input to output.

The parameter "Effectiveness" us a measure to evaluate whether the purpose has been achieved or not, or to evaluate how much the outputs contributed to the achievement of the purpose, or to evaluate whether or not the characteristics of the outputs were as expected.

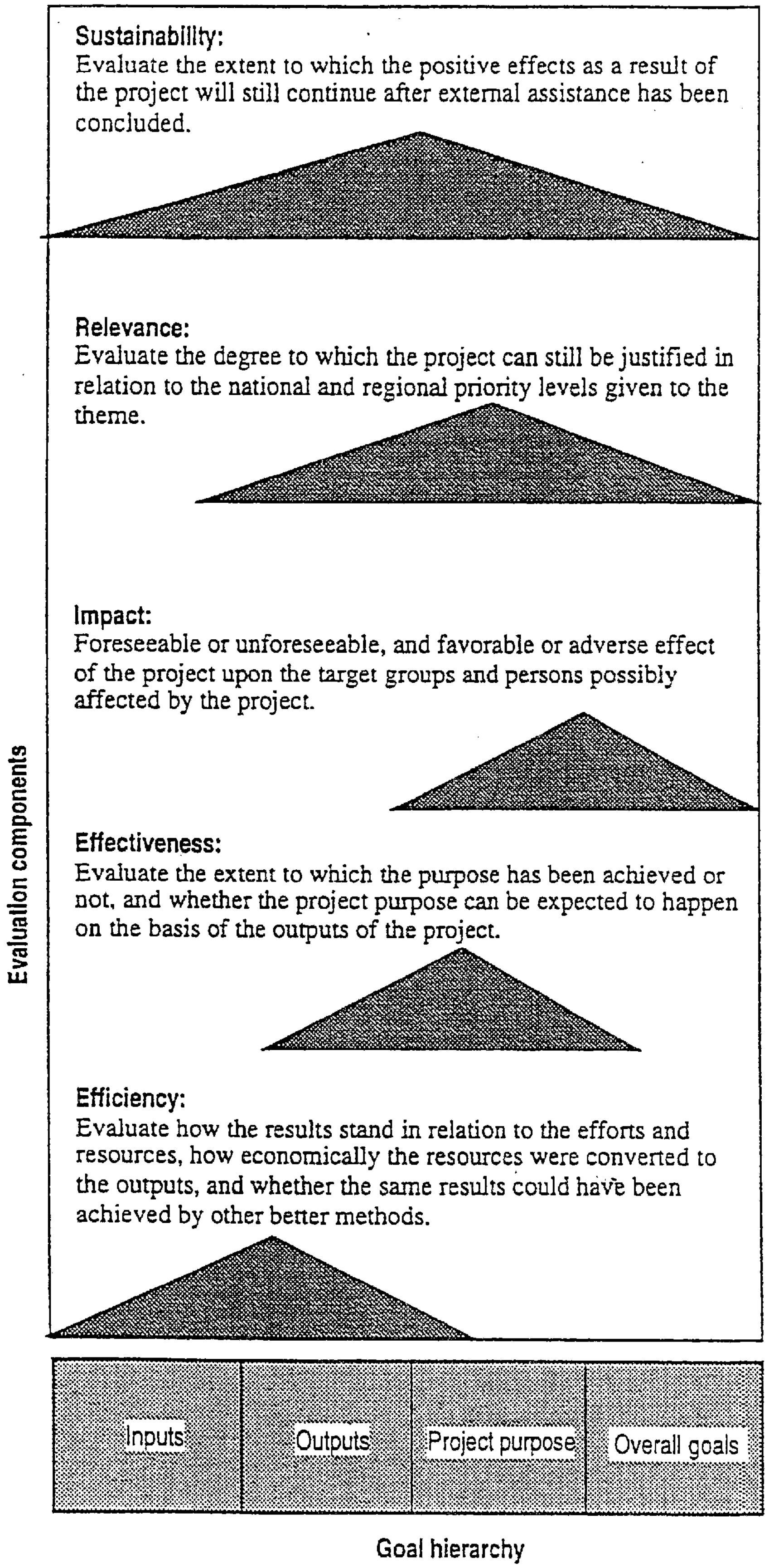
The parameter "Impact" is a foreseeable or unforeseeable, and a favorable or adverse effect of the project upon society. The evaluate impact, both the goal and project purpose should be referred to in the beginning of the evaluation. Evaluation with this components could lead to more than the confirmation as whether or not the goals have been obtained. Evaluation with this component requires comprehensive surveys in many cases.

The parameter "Relevance" is to comprehensively evaluate whether or not the project meets the overall goals, politics of both the donor and recipient, local needs and given priority levels, in order to decide whether the project should be continued, reformulated or terminated.

The component "Sustainability" is to comprehensively evaluate how long the favorable effect as a result of the project can continue after the project has been terminated. Evaluation with this component is required to decide how much the local resources should continue to be used for the project, and to evaluate how much the country receiving the assistance has been considering important. According to OECD (1989), "Sustainability" is a component to be used for the final test of the success of a development project.

All five components are essential for any of the projects or programs. The five components give necessary information to the decision maker so that he/she can decide how to approach the next step. Since each of the five components build on the intervention strategy, they also lay the foundation for standardization in monitoring and information handling within and among organizations and agencies.

In practice, each of the five parameters should also contain project-specific information.



Sustainability:
Evaluate the extent to which the positive effects as a result of the project will still continue after external assistance has been concluded.

Relevance:
Evaluate the degree to which the project can still be justified in relation to the national and regional priority levels given to the theme.

Impact:
Foreseeable or unforeseeable, and favorable or adverse effect of the project upon the target groups and persons possibly affected by the project.

Effectiveness:
Evaluate the extent to which the purpose has been achieved or not, and whether the project purpose can be expected to happen on the basis of the outputs of the project.

Efficiency:
Evaluate how the results stand in relation to the efforts and resources, how economically the resources were converted to the outputs, and whether the same results could have been achieved by other better methods.

Five Components vs. Goal Hierarchy

ANNEX 17

Project Document for the Project on Regional Geological Mapping with Advanced Satellite Data in the Argentine Republic

Chapter 5 Basic Plan of the Project 114

Chapter 6 Implementation System for the Project 129

Chapter 7 Sustainability 135

Chapter 1 Introduction

Argentine has a large territory and a geological environment that is highly likely to contain mineral resources. However, these resources have not been enough explored or developed, resulting in the output of mineral resources still low. One reason identified for that is the lack of a well-arranged stock of basic geological information required for exploring and developing mineral resources. Such information should be collected and arranged efficiently.

To that end, the Argentine government has had its Geological and Thematic Maps National Program in operation since 1993, at the Argentine Geological and Mining Survey (SEGEMAR) under the auspices of the Secretariat of Industry, Commerce and Mining (the mining department was restructured as the Secretariat of Energy and Mining in September 2000). A Remote Sensing and Geographic Information Systems Division (RS/GIS Division) was set up in 1994 to use satellite image analysis (remote sensing) in an attempt to proceed with such mapping efficiently. The reality is, however, that the shortages of personnel and equipment are constraints that prevent these efforts from showing sufficient achievements.

Under these circumstances, the Argentine government asked the Japanese government for project-type technical cooperation in an attempt to increase the efficiency of geological and thematic mapping by introducing advanced technologies for satellite data processing and analysis and equipment and software required for those technologies.

In response, the Japanese government conducted three short-term surveys from June through November 2000 in order to confirm the significance of the project and to draft a project document specifying the basic concepts and a concrete plan, along with other details. Having reflected the survey and discussion findings obtained in these short-term surveys every time such a survey is conducted, and having thus created a final draft, both governments completed this project document and exchanged signatures during the visit of Japanese Implementation Study Team to Argentine in December 2000.

Chapter 2 Background of the Project

1. Social situation of the recipient country

During the past decade, Argentine achieved a major switch from its traditional closed economy to a free and liberated economy based on market economy. While bravely conducting structural reforms according to its philosophy of "a small government and liberalized economy" led by the IMF and the World Bank, the country achieved economic stability and growth. Among the specific results are the termination of inflation and the enhancement of national average income.

On the other hand, the privatization of state-run firms and administrative reforms according to the principle of free economy resulted in major cuts in the number of public employees and the rationalization of private firms also progressed. These factors, together with the worsening of the economic condition stemming originally from the Mexican currency crisis in 1994, have kept the jobless rate at high level over 10%, which is gradually decreasing after the peak in 1996. The structural adjustment policy has also brought about the deterioration of services for low-income persons and a decline in the economic level of the middle class and small and mid-scale farm operators. Due to the lack of competitiveness in the national economy, the increasing burden of interest on external debts, and the recession of Brazil, Argentine still has a trade deficit in the foreign department.

The Economic Growth Five-year Plan, 1995-1999, which was announced in 1995, acknowledged these issues. As high-priority areas of public spending, the plan identifies "better social services for low-income persons," "higher industrial competitiveness," and "reduced gaps in economic development between regions."

The new administration of Fernando De la Rua, established in December 10, 1999, began its work by trying hard to ensure security of foreign investments with the support of the U.S. government and the IMF, with successful results. The new administration also declared a one-year contingency for economy and finance and permitted people to scrap or renegotiate contracts of works, services, or consulting that are considered unlawful, by using the moratorium. Other measures taken included the transfer or voluntary retirement of public employees and across-the-board pay cuts. However, these defensive measures alone are not enough to overcome the difficulties. As a policy of switching to economic offence, it is imperative to explore major industries. For that purpose, the Argentine government has high hopes for its domestic mining industry.

The northern provinces that seem to have high potential for mining are at the present on lower income levels than other provinces. The reinforcement of the industrial foundation of these northern provinces by the possible promotion of mining is expected to lead on a long-term basis to "reduced gaps between regions," which is one of important issues in the development of the country.

Table.1 Poverty Rates by Region (% poor of urban population)

Year	Greater Buenos Aires	North West	North East	Cuyo	Pampeana	Patagonia	All Areas
1990	41.2	54.4	55.7	48.1	33.7	26.7	41.5
1992	18.7	43.1	44.6	30.4	22.6	18.3	24.2
1994	17.0	41.6	40.3	26.1	19.8	17.1	21.6
1996	25.5	48.3	47.5	36.6	28.0	20.9	30.1
1998	24.9	46.0	48.8	36.0	27.4	22.4	29.4
<u>% change</u>							
1990-94	-58.7%	-23.6%	-27.6%	-45.8%	-41.2%	-35.8%	-48.1%
1994-98	46.5%	10.7%	21.0%	38.2%	38.4%	31.0%	36.2%
Lowest 20% share	4.1	4.5	4.1	4.6	4.6	4.3	4.0
Poor, 1998 (millions)	2.9	1.3	1.0	0.7	2.6	0.6	8.6

(Source: INDEC/EPH, various years)

2. Sector issues

(1) History

As compared with Chile, a country that has always been known as a country of mining, Argentine (which is Chile's neighbor across the Andes) has rarely attracted the world's attention in the mining sector because of its little-known resource potential. In 1990, Canadian mining companies began to invest aggressively. They reassessed the Bajo de la Alumbrera mine (copper and gold), which had been dormant since its discovery in 1946, and the world came to pay attention to El Pachon (copper and molybdenum) and other promising mines. In and after 1993, the former administration conducted law revisions to pave the way for investors in the mining field and set up a Federal Mining Council (Consejo Federal de Mineria: COFEMIN) designed to reinforce linkage between the federal and the provincial governments. It also presented as the important challenges of its politics the arrangement of geological information by the federal government and the selection of promising areas with metal mineral resources. Afterwards, the effects of the new Law for Investments in Mining and other laws dramatically improved the investment environment, such as the opening of mine claims to foreign capital and warranty for collecting development funds. As a result, small and mid-size mining companies, which used to conduct mining in the neighbor country, Chile, flowed into Argentine. In the latter half of the 1990s, Argentine came to be evaluated as the country with the best investment environment. In and after 1997, three world-class large mines were launched: the Bajo de la Alumbrera mine for copper and gold, the Salar del Hombre Muerto mine for lithium, and the Cerro Vanguardia mine for gold and silver. As a result of steady rises in production, the mining production rose quickly from $500 million in 1996 to $1.2 billion in 1998, thus showing the effects of the measures taken (Tables 3 and 5). What was more, the various well-arranged legal basis and service firms were attractive to a number of mining companies interested in mine exploration and development. The industry thus boomed little by little (Table 2). In 1997, the gross domestic product (GDP) of the mining sector increased 32% from the previous year, thus showing the true capacity of the mining sector as the driving force for economic growth. From the time when a plan for promoting mining development was launched, mining in fact showed an annual growth rate of 6.9%, which was about double the yearly average economic growth rate of 3.5% in the same period. One can safely say that mining contributed greatly to the national economy.

Table 2 Changes in investments in exploring mineral resources in Argentine

Year	1992	1993	1994	1995	1996	1997	1998	1999
Investments in mine exploration (MMUS$)	7	15	51	80	110	130	100	80

(Source: Secretariat of Energy and Mining)

Table 3 Comparison of changes in total development investments in mining, total mineralproduction, and total mineral exports in Argentine)

Year	1993	1994	1995	1996	1997	1998	1999
Total investments in mining development (MMUS $)	—	23	101	708	658	249	156
Total production of mineral resources (MMUS$)	481	468	513	543	665	1151	1329
Total exports of mineral resources (MMUS$)	16	24	30	36	113	565	791

(Source: Secretariat of Energy and Mining)

Table 4 Trends in copper prices

Year	1994	1995	1996	1997	1998	1999	2000
Producer price of copper (yearly average) Cents/pound	104.65	132.91	104.05	103.24	75.01	71.34	84.00

(Source: ICSG Copper Bulletin)

Table 5 Changes in the production of main metallic minerals

Year	1993	1994	1995	1996	1997	1998	1999
Gold (kg)	937	937	837	723	2,289	20,400	38,515
Silver (kg)	42,744	38,032	47,787	50,399	52,550	35,768	73,788
Copper (t)	—	—	—	—	30,421	170,273	210,126
Zinc (t)	31,395	26,933	32,104	31,093	33,357	35,560	34,192
Lead (t)	11,826	9,981	10,521	11,272	13,760	15,004	14,256
Lithium (t)	—	—	—	—	697	3,428	1,590

(Source: Secretariat of Energy and Mining)

(2) Present situation

Although production of mining sector is still continuing to increase favorably, mining development investment, which is important index to estimate production activities in the future, is now gradually slowing down in recent years. It is considered to resulted from the international economic crises in Asia, Mexico, and Brazil in the latter half of the 1990s and the weakening of the prices of metallic minerals (Table 4). Total investments in mining development has been going down since the 1996 peak (Table 3), with investments in mine exploration also on a downward trend since 1998 (Table 2). Mining investments in 1999 were particularly low, having gone back to its level before the mining boom (Table 3). It is also to be noted that many of the projects that raise high hopes in development have not progressed steadily due to the weakening of metal prices and the poor financial condition of mine-owning firms, along with other reasons. Particularly serious are the states of El Pachon and Agua Rica, large projects of copper mine development which raised high hopes in their early days. These projects were in fact put on hold, one after another. The ones now expected to be launched in development soon are Pirquitas (silver and tin) and Veladero (gold and silver) (Table 6). Under these circumstances, as shown in Table 7, the number of mining companies has been leveling off since 1997. Some reports even say that some small and mid-size mining firms are beginning to retreat. Private miners are still taking a wait-and-see attitude towards the geological promisingness of Argentine, and many firms are said to be unable to decide when and how much to invest. Furthermore, areas with known mineral potential are held by mine firms under the jurisdiction of provincial governments. In addition, the procedure is still complicated for obtaining mining rights from the provincial governments although the investment environment has been improved generally. There are opinions which recognize these factors as obstacles to the promotion of mining investments in Argentine. Another possible obstacle is that U.S. firms, which account for a majority (about 76%) of all mining investments, refrain from investing until the new administration presents a clear-cut policy.

In fact, the National Director of the Mining says that, in Argentine, only about 20% of the seemingly promising area has been subjected to survey borings. Hopes therefore run high for future surveys, including those to be conducted by foreign firms. Expectations are also high for the presence of Japanese firms.

In Japan, too, the Seminar for Mining Investors is sponsored by the Embassy of Argentine every year. However, the only investment made by Japanese mining firms in Argentine is the participation of Mitsubishi Materials Corp. in geological structural surveys in the Los Dos Buhos (Sierra Las Minas) region as part of a joint venture.

Table 6 Cumulative investments in main mines under development in Argentine

Project name	Mineral type	Province	Total investments up to 2005 (MMUS$)
Bajo de la Alumbrera	Copper and gold	Catamarca	1,240
Salar del Hombre Muerto	Lithium	Catamarca	146
Cerro Vanguardia	Gold and silver	Santa Cruz	270
Potasio Rio Colorado	Potassium	Mendoza	100
El Pachon	Copper	San Juan	800
Pirquitas	Tin and silver	Jujuy	124
Loma Blanca	Boric acid	Jujuy	12
San Jorge	Copper and gold	Mendoza	110
Agua Rica	Copper, gold and molybdenum	Catamarca	1,100
Proyectos Polimetalicos	Lead, Zinc, Copper, Silver, Tin	—	30
Veladero *	Gold and silver	San Juan	400
Lama *	Gold and copper	San Juan	950
Nuevos Proyectos de Oro	—	—	150
Inversion PyMEs	—	—	341
Total investments up to 2005 (* represents an estimate)			5,773

(Secretariat of Energy and Mining)

Table 7 Changes in numbers of foreign mining/exploration companies in Argentine

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of foreign mining/exploration companies	4	7	10	17	32	58	62	67	80	80	85

(Secretariat of Energy and Mining)

(3) Prospects

Under such circumstances, a forum was held in Mendoza in August this year, under the title "Argentine Mining 2000 (Increasing Opportunities of Mine Development Business)." The forum attracted 450 attendants from private mining firms, governmental agencies, colleges and other establishments. The event takes place every other year and this one attracted more participants than ever. The main reason for that is said to be the upward trend of copper prices during this year. It follows that, if the metal prices and other circumstances are met, it is implied that Argentine mining has potential for reactivation.

Furthermore, the development of the infrastructure in the mining areas is ongoing and expected to contribute further mining development.

3. Government strategy

(1) History

Argentine presents as a national strategy the promotion of mining investments by foreign firms and the formation of its mining industry as the main industry of the nation in an attempt to rehabilitate its national economy. Under this strategy, the federal government established in 1993 three laws: the Law for Investments in Mining, Law for Restoring the Mining Sector, and Federal Agreement on Mining. The government then established in 1995 the Law for Funding Consumption Tax, Law for Environmental Protection, and Law for Modernizing the Mining Industry. These major revisions of the mining laws considerably deregulated, in general, various tax systems for firms investing in mining, made it free to carry foreign currencies abroad, and made it possible to depreciate various facilities quickly, thus bringing about many advantages to foreign firms. These new laws also permit each province to conduct tenders regarding resting mines, thus ensuring the effective use and distribution of underground resources owned by the provinces. These efforts culminated in Argentine being evaluated as the country with the best investment environment in 1996 and 1997. In fact, in and after 1997, large mines began to operate, resulting in a quick rise in the production of copper, gold, silver, and lithium in Argentine.

(2) Present situation

The new administration of De La Rua, established in 1999, inherits this mining policy, along with the intention to resolve the various barriers identified in the major reforms of the mining laws and to lead to success. The General Coordinator of Mining at the Secretariat of Industry, Commerce and Mining (the mining department is now restructured as the Secretariat of Energy and Mining) stated in an interview with the local newspaper Buenos Aires Herald in February 2000 that the way has been well paved for mining investments in Argentine and that Argentine projects $1 billion of investments per year between 2001 and 2005. He also stated that these investments to increase the economic performance of the economically underdeveloped northwestern regions.

The National Director of Mining announced the important issues on mining policy as follows:

① setting up several additional mine development projects, each on a scale of about $1 billion, making such arrangements as the setup of a uniform tax system superseding the ones different depending on the province, strengthening the competitiveness of mine development, and promoting development,

② promoting the development of the infrastructure required for mining activities,

③ providing geological and mining basic information to create new mining investment,

④ supporting the small and mid-size mines both in terms of technology and management, providing them with information for opening up a road to the international market, helping them find foreign partners, and introducing foreign capital.

The Government of Argentine has so far made no financial suppport for mining companies, whether small or large.

(a) Four important issues

Regarding these four issues, here are the measures actually taken:

① Setting up uniform administration institutions for mining

In conventional practice, all institutions ranging from the setup of mining rights to royalties to the tax system were under the jurisdiction of the provincial governments. Corporate investors in mine exploration thus used to negotiate individually with their provincial governments. However, this diversity of the administration institutions depending on the province entailed some inconveniences, including a long time required for formalities for the approval of mine claims and the possibility of arbitrary decisions being made. These inconveniences are thus obstacles to the promotion of mining investments. With the establishment of the Law for Modernizing the Mining Industry in 1995, the federal government required the provincial governments to open most of the mine claims they own. However, the mine firms run directly by some provincial governments still had promising prospects. Instead of giving mine claim rights to private firms entering the mine claims, these governments give mine development rights and impose option fees and royalties. The new mining laws allow the provincial governments to conduct tenders on their own and allow mine firms run directly by provincial governments to conduct tenders as per contractual provisions to hand over the mine development rights to private firms, thus selecting prospects that remained frozen for a few years. However, in many cases, a mine claim once abandoned was obtained again by a mine firm run directly by the provincial government. Foreign firms wish to explore mines in a free state without a relationship with any province-run mine firm. In northern provinces, however, old unopened mine claim rights have been present for a long time until today, and remain a problem.

Besides the system of mine claim management, some issues remain to be coordinated between the federal and the provincial governments, such as the abolition of stamp taxes and royalties.

To set up a uniform system of mine claim management, the federal government has been reviewing the administrative systems for mining right management and environmental preservation monitoring and building up a uniform system through its PASMA project (Argentine Mining Sector Development Project, to be detailed in the next section, 4. "Previous and ongoing relevant projects") financed by the World Bank. Launched in 1995, the PASMA project is scheduled to be completed by mid-2001 and transferred to the Argentine government.

② Promoting the development of the infrastructure

For the smooth promotion of mine development, it is imperative to arrange the infrastructure. The federal government has set up a Mining Infrastructure Department in the National Mining Direction and has been systematically arranging power and water utilities, along with road arrangement, energy supply and other facilities.
More specifically, a new road crossing the Andes is scheduled to pass through isolated provinces in the northern Argentine. When completed, the road will connect Iquique Port in the northern Chile and Sao Paulo. This road will be lined with two gas pipelines and one

power transmission line. This will facilitate the supply of energy to the mines in the northern Chile and the northern Argentine. In Argentine today, the power required for mining development is supplied by non-utility generation. In this connection, a survey was conducted recently with the cooperation of the TDA of the USA, for the installation of a 500kV high-voltage power line on the line from Catamarca to Mendoza. The energy sources of power are oil and gas abundant in Argentina, and the completion of this high-voltage power line is expected to promote mine development further. In addition, other projects are scheduled, including the reactivation of railroads that have been branch lines.

③ Providing geological and mining basic information

The federal government has since 1993 had its "Geological and Thematic Maps National Program" at the Argentine Geological and Mining Survey (SEGEMAR) under the auspices of the Secretariat of Industry, Commerce and Mining (the mining department is now restructured as the Secretariat of Energy and Mining), in order to collect geological data and reliable information regarding mineral deposit distribution, which are the most important for foreign corporate investors in mining. [This issue will be detailed in 3. "Problems to be Addressed (Arrangement of Geological Information): Present Situation"]

By arranging and disclosing geological information on its own, the federal government wishes to alleviate investor risk, promote mining activities in extracted areas, and reactivate mines whose development projects are put behind and have long been left as they are. In fact, small mining firms are particularly aggressive in seeking reliable information when selecting a mine claim, because they cannot conduct an elaborate survey on their own.

Extracting areas with high resource potential on the basis of geological information owned by the provincial governments is also highly significant when the federal government itself manages useful resources.

④Supporting the technical and managerial aspects of small-to-medium mines

Argentina has more than 800 small-to-medium mining firms. Most of them collect granite, limestone, bentonite, and other building minerals. However, unemployment is coming to the surface due to the slowdown of domestic demand, and the federal government has been taking supporting measures, including considering policies of promoting exports to neighbor countries.

As one of the measures, a program, the National System of Assistance in Mining Technology (SINATEM) began its execution. Its purpose is to strengthen productive activities of small-to-medium mining companies. It provides the companies with a link to the Searching and Development Centers (I&D), which is functioning as a main basis of technology strategy for improving Argentine mining sector's competitiveness. So far, these traditional mining companies have produced non-metal minerals and dimensional stones mainly directed to the domestic market's request. SINATEM promotes actions aimed to improve the production, increase competitiveness, develop new and more valuable products, identify the financing sources for projects which correspond demand in foreign markets.

SINATEM consists of following four components:

- Productive Activities Surveys

-Integral Diagnosis of Enterprises
-Investment Studies
-Market Information

(b) Argentine-Chilean Mining Integration Treaty

Another important trend regarding Argentine's mining policy is the Mining Integration Treaty established in December 29, 1997, with its neighbor Chile. The treaty was approved in Argentine in March 2000 and also approved by the Chilean congress on August 29, 2000. It has entered into force upon the exchange of documents produced in December 2000.

It is a bilateral agreement that allows mining prospecting, exploration, and exploitation. It sets up special legal framework to mine and develop deposits that straddle the border, and eliminates existing restrictions and prohibitions for Argentine and Chilean foreign companies to acquire and constitute rights or interests in property in the frontier zone in which the Treaty is applicable.

The Treaty deals with customs, taxes, migratory, labour, and environmental issues and others. Therefore, cross-border mining projects will enjoy legal measures which takes into account the special characteristics of the mining operations in order to increase production by growing reserves and lowering costs.

A great significance is found in the integration of Argentine, which has petroleum, natural gases and other energy resources and undeveloped promising areas, and Chile, which has a high track record of mining, a complete set of mining-related industries, and some shipping ports on the Pacific Ocean. This integration is considered to promote the reactivation of Argentine mining. Specifically, the arrangement of international roads between Argentina and Chile is expected to increase supplies to Asian countries.

What is more, Argentina has just begun to consider signing a similar mining integration treaty with Bolivia as well. This is again expected to reactivate Argentina's mining.

4. Previous and ongoing relevant cooperation projects

(1) Cooperation projects conducted with foreign organizations and institutions

Table 8 identifies cooperation projects related to SEGEMAR conducted with foreign organizations and institutions.

Table 8 Cooperation projects related to SEGEMAR

Project name	Period	Organizations	Description
Trade Development Project (TDP)	1992－1993	Colorado School of Mines, USA	Satellite image analysis and resource survey in Andean mountainous area
Geoscience Study of the Pampean Ranges	1994－1996	Australian Geological Survey Organization (AGSO)	Geological and geophysical survey in three midwestern provinces in Argentine
Geological Mappping Program	1994－1996	Ibero-American Cooperation Agency (ITGE)	Buildup of a geological information system (GIS)

Argentine Mining Sector Development Project (PASMA)	1995－2001	World Bank	System integration for mining concessions and environmental measurement
Geological Application of Satellite Radars	1997－1999	Canadian Center for Remote Sensing (CCRS)	Creation of a geological maps of two selected areas in southern Argentine by radar images
Multinational Andean Project (MAP)	1997－2001	Geological Survey of Canada (GSC)	Geological and mining resources surveys in the border region of Argentine, Bolivia, Chile and Peru
Hidrogeologic Evaluation of San Luis Province	1998－2000	National Institution for Water and the Environment (INA), BRS (Australia) and the government of San Luis	Water resource survey in San Luis province
BGR-SEGEMAR Agreement	1999－2001	Federal Institute for Geosciences and Natural Resources (BGR), Germany	Geological and thematic survey of Chaco-Pampean Plain

The TDP consisted of a photo-geological analysis of LANDSAT-TM images of 100 areas containing mineral resources in the Andean mountains by a U.S. consultant under the supervision of the Colorado School of Mines, USA. As a result, a number of promising areas with mineral resources were extracted. Immediately after these results were reported in Denver, there occurred a boom for development of Argentine mining.

(2) PASMA project

The objective of PASMA project is to review the administrative system and to build up a uniform management system using satellite data, GPS, GIS and other latest technologies for ① control of mining rights and arrangement of mine claim maps, and ②environmental monitoring.

Designed for Andean mountainous provinces (Catamarca, Salta, Mendoza, San Luis, San Juan, and La Rioja), Phase 1 was implemented for five years, from 1996 through the end of November 2000. Phase 2, designed for the remaining 17 provinces centering on the plains, is being conducted between 1998 and the end of June 2001.

Here is an overview of the project:

① Controlling mining rights and arranging mine claim maps

The project involved reviewing regulations and formalities for legal guaranties regarding mine claim rights, unifying cadastral books for mine claims and other matters, making a database of geological information (as part of this work, geological mapping and aerial geophysical surveys are conducted), and building up a system for controlling mining information on a real-time basis. Regarding the control of mining rights and the arrangement of mine claim maps (creation of cadastral books), the national government has set up a unified form for its collective management, instead of the individual provincial governments managing the matters in their own ways, and has systematized them as a database. Map information is given particular consideration: The database contains information about the roads, mine claim borders, existing mines and other matters on the basis of LANDSAT-TM images.

These cadastral books are already accessible on a web-site (www.suim.gov.ar) of the Unified System of Mining Information (Sistema Unificado de Informacion Minera: SUIM) of the Secretariat of Energy and Mining, which is completed as one of activities in PASMA. Through this site, applicants can receive a guaranty for a mine claim (preliminary sign-up) and obtain approval as an official mine claim holder within about ten days.

② Environmental monitoring

The project involved reviewing the environmental standards and the monitoring system. At the moment, monitoring is under way at 4,950 sites throughout the country, in terms of atmosphere, water quality, soil, ecological system, scenery, and cultural assets. Collected data is integrated into a data system in the form of the cadastral books mentioned above. The coordinates of these monitoring sites are determined by satellite imagery and the GPS, while collected information and map information are converted into electronic files by means of various software packages.

One can safely say that this PASMA project arranged the infrastructure for "unifying the control of mining rights and other administrative systems" and "arranging geological information," which remained unresolved in Argentine, which had been paving the way for its investment environment by its previous law revisions and that it has improved the environment for mining investments even more than ever.

(3) Japan's cooperation projects related to mining

Since 1977, Japan has continually been conducting for Argentine a series of mineral exploration and development projects through JICA and the Metal Mining Agency of Japan (MMAJ). In the 1990s, Japan implemented the following cooperative projects:

1990-1991: Mineral Development Planning Survey in Farallon Negro Area
1991-1994: Basic Mineral Survey in the Western Area
1997-1998: Reconnaisance Survey in the Eastern Andean Regions
1999-2001: Reconnaisance Survey in the Southern Andean Regions

Moreover, "Project on Mine Pollution Control Research Center" (project-type technical cooperation) is being carried out in San Juan Province from 1998 to 2002. One individual expert for "Mineral resources exploration and Mining Investment promotion" has been dispatched to the Secretariat of Energy and Mining since 1999.

Chapter 3 Target Issue (arrangement of geological information): Present Situation

1. Institutional framework of target issue

As described in Chapter 2 ("Background of the Project"), Argentine recognized "Providing geological and mining basic information" as one of the most important issues. As one specific action of the policy, the federal government intends to proceed with the arrangement of geological information on their own. Since 1993, the country has had its Geological and Thematic Maps National Program in operation at the hands of the Argentine Geological and Mining Survey (SEGEMAR) under the auspices of the Secretariat of Industry, Commerce and Mining (mining department is now restructured as the Secretariat of Energy and Mining). The entity that is implementing the Geological and Thematic Maps National Program within SEGEMAR is the Geology and Mineral Resources Institute (IGRM).

(1) Implementation arrangements in IGRM

IGRM has five departments in headquarter, and eleven regional delegations. Each section divide the work as follows:

① Regional Geology Direction (Direccion de Geologia Regional: DGR):

Creates geological maps (1:250,000, 1:100,000).

② Environmental and Applied Geology Direction (Direccion de Geologia Ambiental y Aplicada: DGAA):

Mapping related to the environment and hazards.

③ Geological and Mining Resources Direction (Direccion de Recursos Geologico-Mineros: DRGM):

Conducts geophysical and geochemical surveys.

④ Remote Sensing and Geographic Information System (Unidad de Sensores Remotos y Sistemas de Informacion Geografica: RS/GIS Division):

Provides satellite images (LANDSAT-TM) upon request from other directions, and assists those directions in creating various maps with the help of the GIS.

⑤ Coordination of Regional Delegations (Coordinacion Tecnica de Delegaciones Regionales: CTDR):

Coordinates between IGRM headquarter and regional delegations

⑥ Regional Delegations
11 delegations, which assist IGRM in various local tasks.

(2) Geological and Thematic Maps National Program

(a) Geological map program

① Geological mapping 1:250,000

The Geology and Mineral Resources Institute (IGRM) has since 1993 been creating a geological map with a scale of 1:250,000 in order to arrange basic information. This is the central task being conducted by the Regional Geology Direction (DGR), a bureau consisting of more than 50 geologists and is scheduled to come up with a total of 221 sheets, including those of the mountainous areas. The sheets for the mountainous areas are scheduled to be completed in 2002. The number of sheets remaining is about 70, so that the project is in its final stage. After that, the program is scheduled to cover the entire country eventually in order of descending importance, centering on the plains.

② Geological mapping 1:100,000

In parallel with the above, DGR has since 1997 been creating geological maps 1:100,000. DGR has so far created more than 20 sheets with the cooperation of Australia, Spain, and other establishments. The entire plan is still unclear, but DGR intends, after all, to center on the mountainous areas, thus putting priority on San Juan, Rio Negro, Jujuy, Salta and other provinces that are highly likely to contain mineral resources, mainly Andean region, while considering the requests of all provincial governments. Each sheet is about 1,500km^2, and the map is projected to turn out to be about 1,800 sheets.

(b) Thematic map program

In addition to the creation of geological maps described above, IGRM has been creating thematic maps through its different departments.

① Environment and hazardous area mapping
DGAA produces different kinds of maps upon request from provincial governments and other entities. Among these maps are: maps of landslide-prone areas, maps of disaster areas, maps of flood warning areas, and maps of land uses.

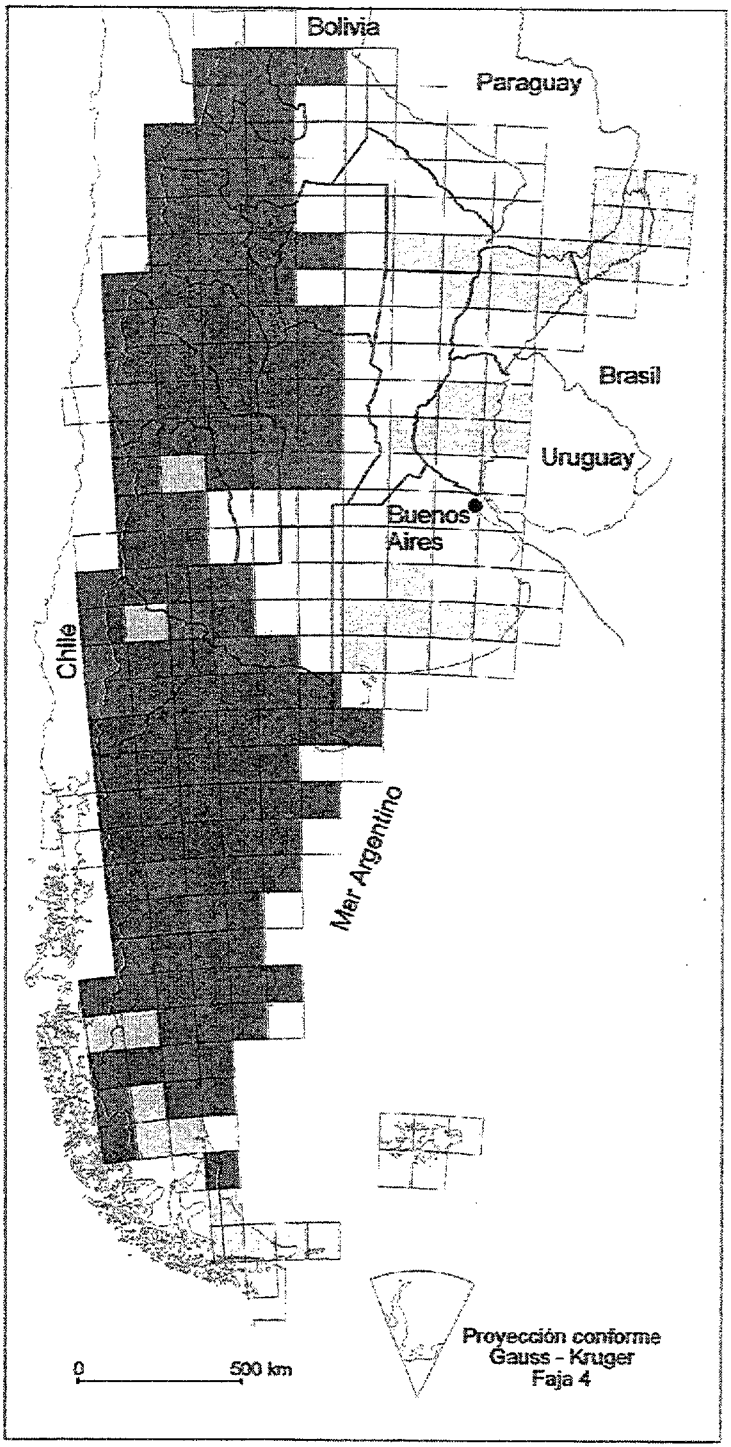
② Geophysical and geochemical mapping
DRGM conducts geophysical and geochemical surveys and analysis.

③ Metallogenic mapping
Last year, DRGM started metallogenic mapping of 1:250,000 scale.

Plan for 2001 and for three years of geological mapping (1:250,000 and 1:100,000) and metallogenic mapping (1:250,000) are as shown in the following pages.

PROGRAMA NACIONAL DE CARTAS GEOLÓGICAS

Escala 1:250.000



REFERENCIAS

■ REALIZADO

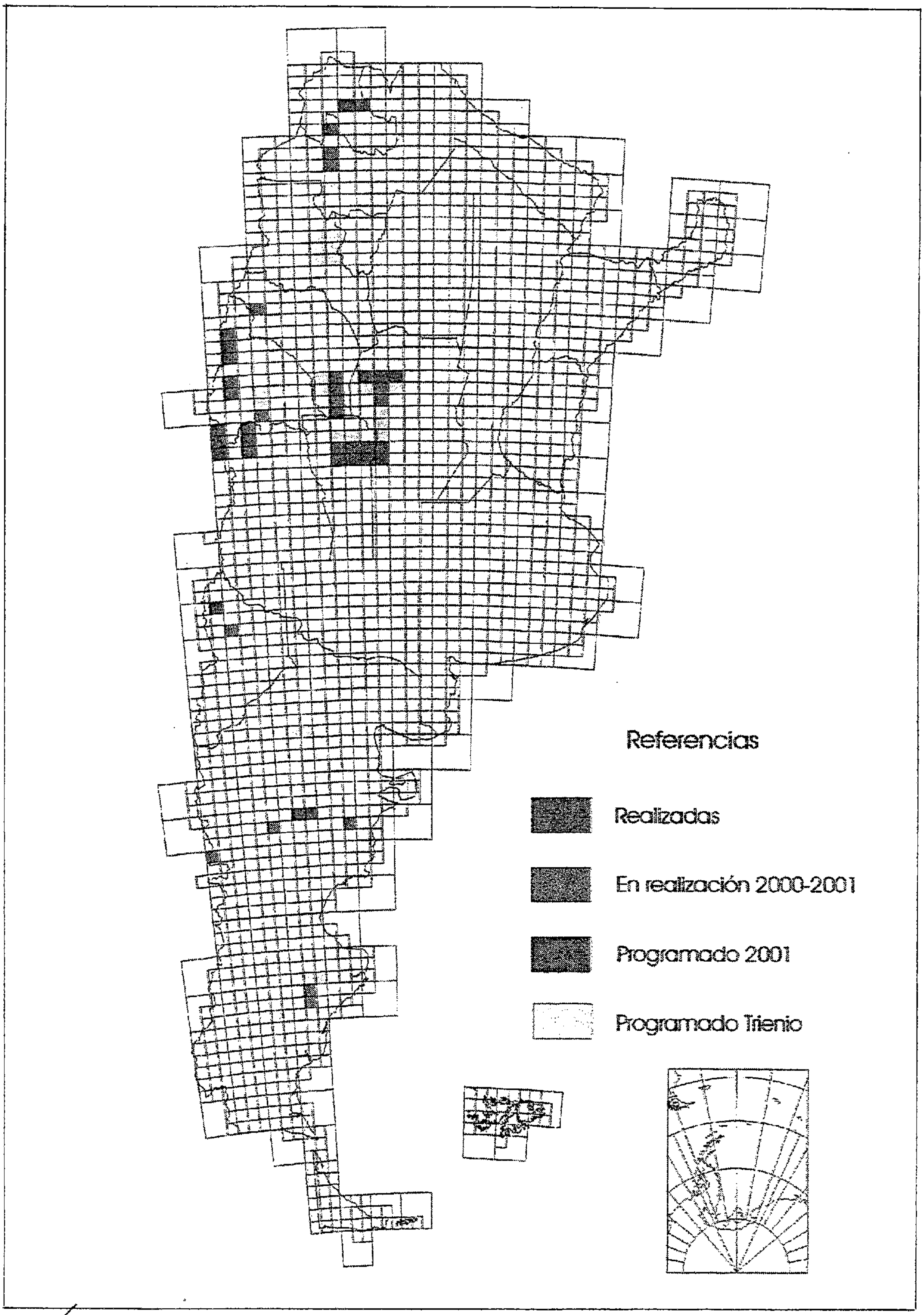
■ EN EJECUCIÓN 2000-2001

░ PROGRAMADO TRIENIO

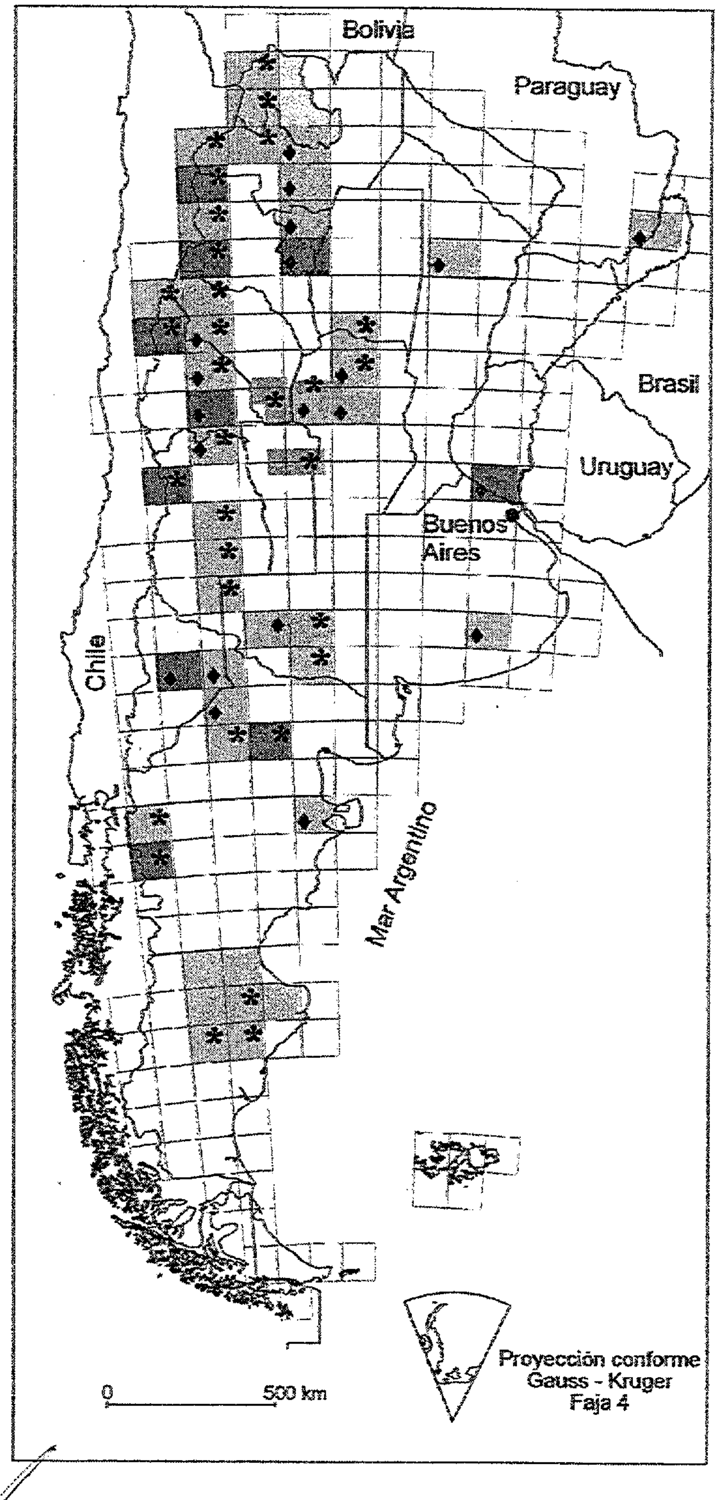
■ PROGRAMADO 2001

INSTITUTO DE GEOLOGÍA Y RECURSOS MINERALES
SEGEMAR
SERVICIO GEOLÓGICO MINERO ARGENTINO

PROGRAMA NACIONAL DE CARTAS GEOLÓGICAS
Escala 1:100.000



PROGRAMA NACIONAL DE CARTAS GEOLÓGICAS Y TEMÁTICAS
LEVANTAMIENTO DE CARTAS METALOGENÉTICAS Y DE MINERALES INDUSTRIALES
ESCALA 1:250.000



INSTITUTO DE GEOLOGIA Y RECURSOS MINERALES
SEGEMAR
SERVICIO GEOLOGICO MINERO ARGENTINO

(3) Budgetary Allocation

Annual Budget for geological mapping and thematic mapping is approximately as follows:

-1:100,000 geological map:	US$25,000 per sheet
-1:250,000 geological map:	US$15,000 per sheet
-1:250,000 metallogenic map:	US$15,000 per sheet
-1:250,000 geochemical map:	6 to 7 sheets yearly
-1:250,000 geophysical map:	4 to 5 sheets yearly
-Environment map:	3 sheets yearly, US$10,000 per sheet
-Hazard map:	3 sheets yearly, US$10,000 per sheet

(4) Outbound information distribution system

SEGEMAR is disclosing lists of maps and information compiled so far, in catalogues and the web-site of SEGEMAR (www.segemar.gov.ar), which is linked with the web-site of SUIM above mentioned.
Users in other organizations are able to send order to SEGEMAR referring to the catalogues or the web-site. Public organizations can obtain them free of charge, and private organizations can do with actual expenses.

2. Present situation and problems

To create these maps efficiently requires the use of the technology for analyzing satellite images (satellite remote sensing). To that end, the Remote Sensing and Geographic Information Systems Division (RS/GIS Division) was set up. The Division is now conducting basic image processing (stretching) on LANDSAT-TM false color images upon request from the DGR (which is in charge of creating geological maps), DGAA (which is in charge of creating hazard and land use maps), or other departments interested in detecting photogeological features.

However, the Division has no experience, technology or equipment for advanced spectral analysis such as mineral mapping, the effective use of the thermal infrared band, or the analysis of vegetation or geographical features, which is a recent resource satellite data enabled. One therefore cannot say that the features of remote sensing are made the most of. Today's challenge is therefore to learn such advanced analysis technologies and take advantage of the features of remote sensing, thus increasing efficiency in creating geological and thematic maps.

3. Significance of the Project within the framework of Japan's assistance policy

One of the high-priority assistance areas identified in JICA's country-specific project plan for Argentine is "correcting the regional and income gaps." One cause of these gaps is the "fragility of the economic basis of certain areas." Among the measures presented in the project plan are "reinforcing the financial base of the poor provincial governments," "developing mines," and "setting up regional development plans."

The project consists of transferring remote sensing technology, thus promoting the arrangement of geological information, in a long-term attempt to increase mining investments. The project thus meets the course of the policy mentioned above.

Chapter 4 Project Strategy

The Project on Regional Geological Mapping with Advanced Satellite Data (hereinafter referred to as "the Project") consists of providing technical cooperation for SEGEMAR to "upgrade the technology for processing and analyzing satellite data" which is necessary for efficiently implementing the Geological and Thematic Maps National Program. SEGEMAR has so far created geological maps 1/500,000, 1/250,000 and 1/100,000 through cooperation projects with international organizations, foreign institutions, and colleges. However, these projects were intended for the creation of geological maps and were not clearly intended for transferring technology to SEGEMAR during the course of the mapping, resulting in the advanced technology not having been transferred sufficiently. On the other hand, this Project aims to enable SEGEMAR staff to learn the technology so that the mapping can continue on their own.

SEGEMAR has already made some use of remote sensing in photogeological interpretation of LANDSAT-TM images in past geological mapping work, so that its staff have already learned the basics of image processing and the technology required for creating geological maps (including field surveys). The Project therefore aims not to transfer technology for the process of creating geological maps but to make an additional step forward. It aims to help SEGEMAR staff to learn processing and analyzing advanced resource satellite data and creating geological maps and thematic maps of better quality more efficiently by making the most of advantage of such data.

The satellite Terra launched by NASA in 1999 incorporates a Japanese-developed sensor ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer), which has many bands in the short-wave/thermal infrared band (that is, it is suited for obtaining information useful for resource surveys, such as classifications of altered minerals and lithological classifications according to silica content). The sensor has already started acquiring data. The Project is therefore going to use ASTER data mainly.

Among the conceivable types of data sets that take advantage of the features of the ASTER are classification maps of altered minerals, lithological classification maps by silica content, and digital elevation model (DEM). These data sets are useful for conducting field surveys efficiently as supplementary information in creating 1:100,000 geological maps and 1:250,000 metallogenic maps, which is to be implemented by SEGEMAR on its own. Besides, it is also useful for other various purposes, for example, utilizing as basic information for mineral resources prospecting or environmental/hazardous area/topographical mapping.

The actual technology transfer will aim to allow SEGEMAR staff to learn how to create these data sets and how to utilize the data sets on geological mapping and thematic mapping, mainly through On-the-job Training. However, it will be impossible to create geological maps and thematic maps for the entire regions that are highly likely to contain mineral deposits during the project. SEGEMAR is therefore to continue creating these maps on its own after the project.

Furthermore, as activities of the Project, workshops and seminars will be held for personnel other than the Project staff and for non-SEGEMAR personnel to disseminate information about the basic concepts, utilization methods, and other matters regarding remote sensing, aiming at paving the way for the increased use of remote sensing in and outside SEGEMAR.

Remote sensing is a field still under technical development at a rapid rate. When the Project is over, even more advanced satellite data and technologies for analyzing it are expected to have been developed. The technologies for processing and analyzing ASTER data can be the basis for learning more advanced technologies after the Project.

SEGEMAR wishes to use remote sensing technology in building up the Federal Emergency System (a disaster information network), whose planning has been under way since the former administration.

The Project is therefore scheduled to introduce not only the technology for processing and analyzing satellite for resource surveys as described above but also the methods of applying it to disaster prevention and environmental applications. However, the actual process of creating thematic maps for disaster prevention and environmental application needs a good understanding of not only the technologies directly linked to remote sensing but also the disaster prevention and environmental issues in Argentine. It is therefore considered to be difficult to transfer remote sensing technology of application to hazard and environmental analysis in parallel with the resource remote sensing mentioned above. The Project will take the basic stance of not actually creating thematic maps for hazard and environmental analysis. It will instead be confined to presenting methods of application.

Chapter 5 Basic Plan of the Project

1. Master plan (Super goals, Overall goals, Project Purposes, and Outputs)

This Project aims to allow SEGEMAR, more specifically IGRM under it, to learn to use advanced satellite date for (A) geological and metallogenic mapping for exploring mineral resources, and (B) environmental and hazard analysis.

As will be detailed in (1) "Project Purposes," the scope and degree of technology transfer to be conducted during the cooperation period of the project varies between A and B. They have therefore been divided into separate sub-projects.

(1) Project purposes*

*An objective that is expected to be achieved as a result of project implementation and whish is revealed in the form of specific benefits or impacts for the target group

Sub-project A

"IGRM is able to utilize advanced satellite data such as ASTER and/or PALSAR in order to make geological maps and thematic maps for mineral exploration."

Sub-project B

"IGRM understands how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental or hazardous area study."

The difference between the two sub-projects is as follows:
The sub-project A aims to enable IGRM to actually use data from ASTER and/or PALSAR when compiling geological and thematic maps (such as metallogenic maps).
The sub-project B, on the other hand, will be confined to something like an introduction designed to allow IGRM to understand in what form the ASTER and PALSAR data will be useful in environmental and hazard area analysis. Why? Because, in environmental and hazard area analyses, the elements other than satellite data (including the local characteristics) account for a very large percentage in evaluating environmental effect or possibility of hazard, and mapping. In that sense, what Japan can do will be confined to an introduction to the techniques, not guidance covering the entire mapping practice.

(2) Overall goals* and super goal**

*The effect of a development project expected to be attained (after the project ends) as a result of the Project Purpose being achieved

**Effects that the project aims to achieve by achieving the "overall goals"

Sub-project A

- Overall goal

"Geological maps and thematic maps for mineral exploration using advanced satellite data are prepared by IGRM."

This Project will cover all processes up to the transfer of technology required for geological and thematic mapping. The actual geological and thematic mapping work of the target areas in Argentina using that technology will be the responsibility of IGRM. Making geological and thematic maps that cover the target areas will presumably be time-consuming. This goal will therefore be something to be achieved by IGRM on its own after the Project is over.

For this goal to be achieved, it is imperative for IGRM to arrange personnel and take budgetary measures necessary for the mapping of the target areas, in addition to the technology transfer in the Project. Although IGRM is responsible for taking these measures, one cannot deny the possibility of IGRM budget being cut under the country's severe financial condition. It is particularly to be noted that, since part of staff engaged in this project are not government employees but contract personnel that need contract renewal at certain intervals, one cannot say that there is no possibility that the technology transfer may be in trouble due to a change in personnel assignment as a result of a budget cut. One can therefore say that this is one of the important assumptions* for achieving the overall goals.

*Conditions that need to be satisfied for the project to succeed, but which cannot be controlled by the project and whose occurrence or non-occurrence is uncertain

- Super goal

"Geological maps and thematic maps prepared by IGRM are utilized by mining investors in Argentine."

The geological and thematic maps will serve various uses. Among them, the long-term goal that this Project emphasizes most is that the these maps as basic information for exploring mineral resources will help promote mining investment.

However, for mining investment to be reactivated actually, needless to say, various conditions should be met, such as the compilation of geological and thematic maps, the trends in international metal prices, and the effective functioning of the nationally unified system for setting mining rights launched by the PASMA.

Sub-project B

- Overall goal

"Thematic maps for environment conservation and hazard prevention are prepared by IGRM."

When IGRM staffs who have acquired the necessary knowledge through the introduction in this Project learns the techniques for actual mapping, they will be able to achieve this overall goal. However, for the reason stated in (1) "Project Purposes," this mapping technology will not be included in the technology to be transferred as part of the Project.

Concerning this Overall Goal, similarly to the Overall Goal of the sub-project A, the important assumption will be that the personnel and budget measures required for the mapping will be provided.

(3) Outputs*

*Several objectives that must be achieved for the Project Purpose to be attained. Outputs are expected to be achieved by implementing Project Activities

Sub-project A

1. System for utilizing satellite data is established in IGRM.

2. Equipment and advanced satellite data necessary for utilizing satellite data are operated and maintained properly.

3. IGRM geologists have enough technology to utilize advanced satellite data such as ASTER and/or PALSAR on geological and thematic mapping for mineral exploration

4. Usefulness of the remote sensing technology is understood by the persons concerned and users through seminars and workshops.

The purpose of this Output 4 is to inform not only the counterpart personnel engaged directly in this Project but a wide range of IGRM personnel as well of what the remote sensing technology is and how useful it is in geological and thematic mapping, thus forming the basis for the technology transferred through this project to get established and develop. Another purpose is to appeal to external persons concerned (such as those of governmental organizations, private firms, research institutes, and colleges) about the usefulness of advanced satellite data and that of geological and thematic maps compiled by IGRM using such data.

Sub-project B

1. System for utilizing satellite data is established in IGRM.

2. Equipment and advanced satellite data necessary for utilizing satellite data are operated and maintained properly.

3. IGRM geologists know understand how to utilize advanced satellite data such as ASTER and/or PALSAR in environmental or hazardous area study

Here are the areas of technology area in the Outputs 2 and 3 for both the sub-projects A and B.

I. Data handling and fundamental concept of earth resources satellite data
    1. Introduction to new hardware and software
        a. Hardware management
        b. Software handling (remote sensing, GIS, others)
        c. Data management (raw data, image products)
    2. Basic concept of remote sensing and its application to geological use
        a. Visible and near-infrared (VNIR), and short-wave infrared (SWIR) sensing
        b. Thermal infrared (TIR) sensing
        c. Stereoscopic image and digital elevation model (DEM)

    - d. Microwave sensing
    - e. Satellite platform, orbit, data acquisition
    - f. Case studies of geological mapping based on various remote sensing data
  - 3. Effective use of ASTER data from pre-launch studies

II. Digital image processing and thematic mapping of alteration minerals and lithology with silica content by ASTER data
  - 1. Pre-processing (data loading, line replacing, geometric correction, mosaicking)
  - 2. Image enhancement (stretching, filtering, statistical treatment, fast Fourier transform, others)
  - 3. SWIR analysis
    - a. Methodology to obtain apparent reflectance
    - b. Construction and management of spectral library
    - c. Methodology of mapping alteration minerals (binary encoding, spectral angle mapping, matched filtering, spectral unmixing, others)
  - 4. TIR analysis
    - a. Separation of emissivity from temperature
    - b. Silica abundance estimation based on emissivity spectra

III. Application of ASTER data to geological mapping and mineral resources exploration
  - 1. Alteration mineral mapping based on SWIR data
    - a. Three-dimensional interpretation of common hydrothermal systems
    - b. Geological interpretation based on SWIR mapping results
    - c. Field verification for improving mapping quality
    - d. Operation of spectrometer and data acquisition of reflectance spectra in the field
  - 2. Lithologic mapping by TIR data
    - a. Extraction of silica-introduced portion in hydrothermal systems
    - b. Lithologic interpretation based on emissivity spectra
    - c. Field verification for improving mapping quality
    - d. Operation of radiometer and data acquisition of field emissivity spectra
  - 3. Application of DEM data to geology
    - a. Data handling and analytical method
    - b. Geological analysis by DEM
  - 4. Integration of remote sensing analysis and geological field survey
    - a. Comprehensive analysis of VNIR/SWIR/TIR mapping results
    - b. Integrated Interpretation* of geology and mineral resources (mineral potential analysis)

* Integrated interpretation

This Project will transfer technology and know-how of integrated interpretation for geological and metallogenic mapping, based on data sets made by the RS/GIS Division, adding field survey results, existing data of geochemical and physics surveys and maps.
However, this Project focuses on "processing, analysis of satellite data, and use of the result" instead of targeting the entire process of resource surveys. Therefore, the integrated interpretation mentioned here will be narrowed down to "comprehensive analysis technology and know-how required particularly for using satellite data sets when compiling geological maps and metallogenic maps," instead of referring to the entire integrated interpretation (such as geological interpretation) which is generally conducted in resource exploration.

IV. Microwave analysis using PALSAR data
  1. Data handling and image processing (data loading, noise mitigation, correction of distortion, mosaicking, others)
  2. Land use analysis (forest analysis) by radar polarimetry
  3. Topographic analysis by radar interferometry

V. Introduction to environmental analysis using ASTER and/or PALSAR data
  1. Land use analysis (provisional)
  2. Vegetation index analysis (provisional)
  3. Soil index analysis (provisional)

VI. Introduction to hazardous area analysis using ASTER and/or PALSAR data
  1. Flood level observation (provisional)
  2. Coastal line monitoring (provisional)
  3. Drought monitoring (provisional)
  4. Volcano monitoring (provisional)
  5. Land slide monitoring (provisional)

There are a great variety of methods of using satellite data in environmental and hazard analyses. Of these, the ones assumed by IGRM are as follows:

- Contamination (soil, water and atmosphere)
- Changes in the scenery due to soil mass movement (landslide)
- Flood level
- Changes in shorelines
- Active faults
- Droughts

However, since this Project is designed to transfer the method of using ASTER and/or PALSAR data, the requirements have been narrowed down to the items V.1 through 3 and VI. 1 through 5 listed above, in view of the characteristics of the ASTER and PALSAR. Concerning these items, "application to environmental and hazard area surveys" of ASTER data in Japan has not yet been put to practical use on a full scale and still in the stage of research and development. The plan is therefore given provisional status.

VII. Introduction to hyperspectral analysis

2. Activities

Here are the specific activities to be conducted in this Project in order to achieve the outputs listed above.

The schedule for these activities is indicated in the Plan of Operations attached hereto.

Activities	Description
1-1 Allocate staff as planned	
1-2 Make the plan of operation	
1-3 Make the budgetary plans	
1-4 Make and implement the monitoring and evaluation plan	
1-5 Operate the joint coordinating committee	
2-1 Make and implement equipment operation and maintenance plan	
2-2 Establish and operate data management systems	Concerning ASTER data obtained and accumulated, and products and data set produced, teach the C/Ps to manage and store them by means of the ASTER data management system to be introduced and taught by short-term experts during the third quarter or the fourth quarter of the first Japanese fiscal year.
2-3 Procure and install necessary equipment	
2-4 Allocate budget for operation and maintenance of the equipment	
2-5 Teach C/Ps how to operate and maintain the equipment	
(Sub-project A)	
A3-1. Training for hardware and software	Build up a digital image processing system with the equipment to be procured in the first Japanese fiscal year. This system will consist of a work group formed under the network server and individual software packages installed there. During the first quarter of the first Japanese fiscal year, supervise and building up this system and guide C/Ps in the techniques for operating and controlling this system. In the steady-state operation stage, guide them in maintaining the system and replenishing and controlling consumables and other supplies. In and after the second quarter, guide the C/Ps in the techniques for operating the software installed and give them explanations and instructions on how to handle ASTER data (retrieval, processing requests, and method

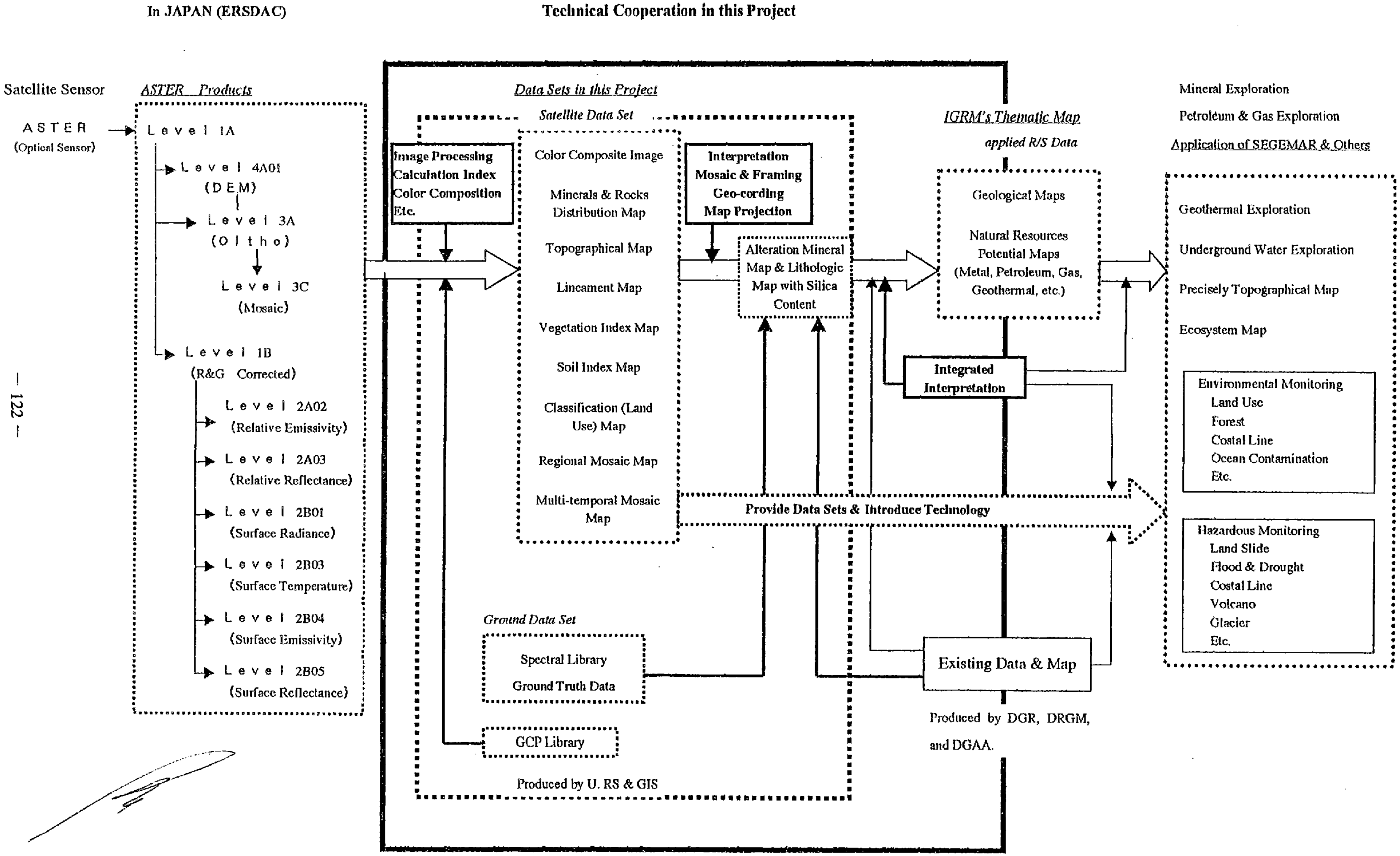
	of data management).
A3-2. Introduce interpretation examples by using ASTER simulation data	Teach the C/Ps the characteristics of ASTER data and how to apply them to geological analysis by means of simulation data, till obtaining actual ASTER data.
A3-3. Teach C/Ps how to process ASTER data	Concerning digital image processing, teach the C/Ps how to conduct reformatting and initial processing (such as color synthesis, highlighting, filtering, resampling, inter-band registration, and ratio calculation) of ASTER data, and teach them to produce ASTER products and ASTER data sets on a steady basis. Concerning the ASTER DEM, which is a major ASTER product, use short-term experts to introduce the software and guide the C/Ps during the second quarter and guide them how to use and analyze it when necessary.
A3-4. Teach C/Ps how to use DEM data	Teach the C/Ps how to compile topographical maps, and how to create 3-D images based on ASTER data and to analyze the geology and geological structure by photo interpretation.
A3-5. Teach C/Ps how to make alteration mineral maps and lithological maps by silica content	Using short-wave infrared data and thermal infrared data, which are the greatest characteristics of ASTER data, create alteration mineral maps and lithological maps by silica content. For that purpose, teach them how to perform data operations and interpret images thus made.
A3-6. Teach C/Ps how to conduct field surveys for alteration minerals mapping and lithological mapping by silica content	Teach the C/Ps how to interpret alteration mineral maps and lithological maps by silica content and how to verify the results with a spectrometer, radiometer, and GPS in field survey.
A3-7. Teach C/Ps how to perform integrated geological interpretation using ASTER data	In addition to the method of making geological maps by TM, which has been used by SEGEMAR, teach the C/Ps that the results of ASTER data analysis and the results of field surveys to be added, thus increasing efficiency and precision. Of the regions subject to 1:100,000 geological maps and 1:250,000 metallogenic maps (for the year 2001, ten geological maps and six metallogenic maps are scheduled) in the Geological and Thematic Maps National Program, four geological map sites and one metallogenic map sites will be used each year as the model sites for this Project. The regions to be mapped in the Geological and Thematic Maps National Program will be officially determined on the basis of a draft made by SEGEMAR and subject to deliberation at the Federal Mining Council (COFEMIN) in December each year.
A3-8. Teach C/Ps how to analyze	Demonstrate that geological classification using SAR

PALSAR data	polarization and interferometry is effective in Pagagonia in the southern Argentine and other areas where optical sensor data is difficult to obtain and have them understand that it helps make geological mapping more efficient.
A3-9. Teach C/Ps how to analyze hyperspectral data	Have the C/Ps understand the identifiability of minerals in the surface of exposures using ultra-multi-band data.
(Sub-project B)	
B3-1. Teach C/Ps how to conduct environmental analysis by ASTER and/or PALSAR data	Teach the C/Ps how to conduct environmental analysis using the characteristics of ASTER and/or PALSAR data and have them understand higher-precision methods of interpretation combined with existing data.
B3-2. Teach C/Ps how to conduct hazardous area analysis by ASTER and/or PALSAR data	Teach the C/Ps how to analyze hazardous areas by using the characteristics of ASTER/PALSAR data, and have them understand higher-precision methods of interpretation combined with existing data.
B3-3. Teach C/Ps how to conduct field survey to verify the results of environmental and hazardous area analyses	Teach the C/Ps the kinds of, and how to obtain, field data required for environmental and hazard analysis using satellite data.
4-1. Hold seminars and workshops	Give IGRM staffs explanations of the basic concepts of remote sensing and hold workshops to teach them how to use the data. Provide IGRM staff and external users with seminars to appeal to them about the usefulness of data from advanced satellites and geological and thematic maps based on such data.

3. Products and their application

Chart 1 on the next page is a schematic chart indicating the flow where data sets are produced from standard products of ASTER data made by ERSDAC in the Project, and are actually used both in and outside SEGEMAR.

Concept on Flow of Products and Their Application in the Project



4. Input

(1) Input by the Japanese side

(a) Dispatch of Japanese experts

Long-term experts

Experts covering the four fields listed below will be dispatched for four years. The division of work among the experts in their actual activities is indicated in the "In Charge" column of the Plan of Operations.

① Chief advisor
-Supervision of the entire Project tasks
-Organization of plans required to perform cooperation activities
-Budget management
-Equipment management
-Reinforcement of the communication and liaison system with the Japanese side, etc.

② Coordinator
-Assistance to the Chief advisor
-Monitoring of the progress status of the entire management of the Project
-Promotion of problem-solving in project implementation
-Budget management
-Equipment management
-Liaison and coordination, etc.

③ Digital image processing
-Introduction of the digital image processing system
-Guidance on the operation of the digital image processing system
-Training of the abilities of management (such as selection, obtaining, processing, storage, and distribution) of satellite data and data sets created
-Guidance on techniques for using advanced satellite data

④ Geological remote sensing
-Explanation of ASTER data characteristics
-Validation of usefulness of ASTER data through photo-interpretation of ASTER image(s) and field survey, if necessary , of the target area(s) which has (have) a lot of known data
-Guidance on how to use ASTER data to increase the efficiency of geological and metallogenic mapping and to add information

Short-term experts

Of the areas of technology transfer listed in 1. Master Plan, (3) Results, the areas with specialized and leading-edge technologies and the areas with technologies for environmental and hazard analysis and other areas that are difficult to handle by long-term experts alone will be handled by short-term experts, who will be dispatched for that purpose. The dispatch schedule for those experts will be negotiated by Japan and Argentine every year. The fields assumed at the moment are as follows:

- Introduction of ASTER
- Installation of DEM software
- Installation of data management system
- Application of SAR data
- Environmental analysis
- Hazardous area analysis
- Application of hyperspectral data

(b) Training of C/Ps in Japan

About two C/Ps will be trained in Japan for any duration ranging from two to three weeks to about two months (depending on the contents to be taught).

This training will be conducted to teach the C/Ps the methods of work of the ASTER researchers and users engaged in image processing, mineral resource-related work, and environmental analysis and hazard prevention researches and to allow them to conduct a case study of some researches, thus promoting the use of ASTER data after they return home. Also possible is the participation of C/Ps in the ASTER Science Team Meeting to be held between late May and early June each year.

Here are some possible organizations that may receive the C/P trainees:

- General seminar on remote sensing
  RESTEC (about one month)
  ERSDAC (one day)
  Tokai University, Science and Technology Institute (about a week)

- Technical seminars on geological remote sensing technology
  Geological Survey of Japan, International Cooperation Office and the Geological Remote Sensing Laboratory (one to two weeks)
  Faculty of Earth and Planetary Sciences, Graduate School of Science, Nagoya University (about a week)

- Application to mineral resources and case study
  MMAJ and six resource development consultant firms (about a week)
  MMAJ Kosaka Technology Institute (2-3 days)

- Application to environmental and hazard analysis
  Tokyo University, Production Engineering Institute (2-3 days)
  National Institute for Environmental Studies (2-3 days)
  Chiba University, Environmental Remote Sensing Research Center (2-3 days)
  National Institute for Disaster Prevention
  Tokyo University
  Nagoya University, etc.

(c) Provision of equipment

For the equipment to be provided and its specifications, see the List of Equipment.

① Digital image processing system
The smallest unit of the digital image processing system is that IGRM should be able to perform various operations on ASTER data for use in geological and thematic maps to be compiled by IGRM during the implementation period of this project. In addition, this system has been designed to allow IGRM to obtain, process, compile, and manage ASTER data and ASTER data sets on its own after the project is over, and to offer ASTER data and ASTER data sets quickly in response to requests from SEGEMAR and other establishments.
This system has also been designed so that high-level ASTER processing of level 2 and higher can be conducted by Argentine (IGRM) on its own, without depending on the Japanese side (ERSDAC).

② Equipment for field surveys
Field surveys will be conducted basically by means of the equipment currently owned by IGRM. The Japanese side will in addition provide the items of equipment listed below, which are considered to be necessary for performing ground truth on satellite data.

- Spectrometer
The electromagnetic wave band including ASTER visible near-infrared data and short-wave infrared data regions will be observed on the field in detail to enable observations of the meaning of the tones and the method of data operations to be used when ASTER data is converted to imagery. At the same time, part of the field verification of image interpretation results will be conducted by measuring the optical spectrum.

- Radiometer
The electromagnetic wave band of ASTER thermal infrared data region will be observed on the field in detail to enable observations of the meaning of the tones and the method of data operations when ASTER thermal infrared data is converted to imagery. At the same time, part of the field verification of image interpretation results will be conducted by measuring the thermal infrared spectrum.

- GPS
The GPS will be used to record survey points accurately in order to increase the coordination precision of field measurements with images. In Argentine, topographical maps are not sufficient and there are areas with few topographical characteristics. The topographical features of the country will therefore be recorded and stored as numerical information through the GPS.

③ Satellite data
The Japanese side will provide ASTER data, which will be mainly used in this Project, within the range required for technology transfer. Since it is better to purchase data after enough data of good condition is prepared, the third year (the 2003 Japanese fiscal year) is considered to be suitable for the timing of procurement. However the data is also necessary for technology transfer before that. Thus, the Japanese side will make advance coordination with the

organizations concerned in order to acquire the data free of charge in the first year and the second year, using joint research program (ASTER Announcement of Research Opportunity (ARO)) which is implemented by ERSDAC, or with cooperation by ASTER Science Team. In addition, data offered by these methods is for the research purpose, and using the data for purposes other than researches, such as sale to the exterior of products which is made by processing and analysis of the data, is not allowed in principle. For this reason, it is necessary to purchase the data again in the 3rd fiscal year, even if the same one has already been offered by these methods.

(2) Input by the Argentine side

(a) Personnel assignment

Personnel will be assigned as summarized below for this Project.

Roles in this project	Department and position in SEGEMAR		Remark
Project Director	President of SEGEMAR		
Project Manager	Director of IGRM		
Coordinators	Acting Director of RS/GIS Division Director of DGR Director of DRGM Director of DGAA		
Full-time counterparts	4 staff members of the RS Section, RS/GIS Division		Will be C/Ps mainly for long-term experts for digital image processing and, in some parts of the technology, for long-term experts for geological remote sensing.
Part-time counterparts	RS/GIS Division	GIS administrator, RS/GIS network administrator, and others, 4 in total (scheduled)	
	DGR	About 20 geologists	Will be C/Ps mainly for long-term experts for geological remote sensing. Although name and position of the C/Ps have not been determined at this moment, DGR and DRGM geologists who belong to teams in charge of 5 model sites (four 1:100,000 geological maps and one 1:250,000 metallogenic map) which is seleced yearly.
	DRGM	About 8 geologists	
	DGAA	About 4 geologists	Will be C/Ps mainly for short-term experts in environmental and hazard analysis.

The division of work in actual activities among these personnel is summarized in the "In Charge" column of the Plan of Operations.

(b) Building and facilities

SEGEMAR will provide the space in RS/GIS Division located in the building used currently by IGRM.

(c) Budgetary allocation

SEGEMAR now allows for a budget as specified below, for the implementation of this Project.
To secure this budget actually, SEGEMAR should make draft of budget request for the next year by June, have it investigated by Ministry of Finance, and get approval of the Congress every year. Therefore, the budget plan is finalized around December, immediately before the startup of Argentine fiscal year (starting in January, and ending in December).
The budget after 2002 is not necessarily same as described in this chart. It is going to be revised concerning the actual disbursement, if necessary.
The budget which is acquired for every year can not be carried forward to the next year.

Items	2001	2002	2003	2004	2005 Jan. to Mar.
Expense related to equipment					
Software maintenance / up grade	8,000	8,000	12,000	12,000	2,000
Hardware maintenance	7,000	7,000	8,500	8,500	500
Consumables (paper, ink, toner, CD, others)	5,000	5,000	6,500	6,500	500
ASTER data delivery	5,000	5,000	5,000	5,000	1,000
Expense for Field Survey					
Air tickets / transportation	4,000	4,000	4,000	4,000	1,000
Field Allowances	56,000	56,000	62,000	62,000	5,000
Field Operative Cost (assistants, oil, truck maintenance, library, photography, others)	15,500	15,500	15,500	15,500	2,000
Expense for Samples analysis					
Chemical analysis		4,000	5,600	5,600	1,500
K-AR / U-PBS age determination		10,000	14,000	14,000	3,000
Petrography Slide Sections		3,800	5,200	5,200	1,500
Expense for Seminar / Workshop	2,000	2,000	2,000	2,000	
Expense for Part time Data Entry	5,000	7,200	7,200	7,200	2,000
Total by year	107,500	127,500	147,500	147,500	20,000
Total of 2001 to 2005					550,000

Basis of estimation is as follows.

-Expense for Field Survey and Sample Analysis
Four (4) 1:100,000 geological maps and one(1) 1:250,000 metallogenic map will be created every 18 months. Mapping for the first five (5) maps is going to start in the latter half or Japanese fiscal year 2001. Therefore, mapping work of eight (8) geological maps and two (2) metallogenic maps will have been completed, and that of four (4) geological maps and one (1) metallogenic map will have been launched, at the termination of the Project.
The above mentioned amount is estimated based on the case where field survey is conducted twice for each map (site).
In addition, field survey will be conducted, not only for this mapping work, but also for training of more general technology.

-Expense for seminar / workshop
Four seminar(s)/workshop(s) by year will be developed in order to show the new technology to all the professionals in SEGEMAR, universities, national and provincial organizations, companies and consultants. Two of the seminar(s)/workshop(s) will be held in Buenos Aires,

and the other two will be held in the Provinces.

Besides, the following expense, whose necessary amount is not clear, is also borne by the Argentine side, other than the expenses mentioned in the budgetary plan shown above.

-X-ray analysis
It will be done in laboratories of Mining Technology Institute (Instituto de Tecnologia Minera: INTEMIN).

-Vehicles
Vehicles owned by IGRM will be used in field survey.

(d) Equipment

In addition to the equipment currently owned by RS/GIS Division to be used for this Project whenever necessary, SEGEMAR will provide vehicles and field survey tools (e.g. hammers, GPS), along with clerical and audiovisual equipment required for seminars and workshops.

Anyone wishing to use any vehicles in long-term (about one month) field surveys must apply six months in advance. In particular cases when early planning is difficult, such as field survey for training of general technology in the early stage of the project and at the time of a visit by short-term experts, such vehicles will be made available whenever necessary even if no application was made six months in advance.

5. Prior obligations and requirements

The Argentine side will implement the items listed in 4. "Implementation" above and make efforts to satisfy the requirements specified in Chapter 7 "Autonomous Development."

Chapter 6 Implementation System for the Project

1. Implementing Agency

(1) Eligibility of the implementing agency

From 1885 on, Argentine was conducting surveys and researches in geology and mining through various public organizations. The reforms of the administrative structure in 1996 entailed the setup of SEGEMAR, so that the responsibilities for these surveys and researches were integrated in the form of SEGEMAR.

SEGEMAR is therefore responsible for arranging and offering geological information as the operator of the Geological and Thematic Maps National Program. It is thus the most eligible candidate as the beneficiary of the proposed technology transfer for creating geological maps and thematic maps using remote sensing in the Project.

The remote sensing technology to be transferred in this Project is expected to enjoy needs for technology transfer in geological and mining-related research institutes, colleges, and private firms as well. SEGEMAR has previously held seminars for these establishments and organizations. It is therefore presumed possible to transfer and disseminate in a similar form the technology which will have been transferred in the Project. In view of these considerations as well, SEGEMAR is the appropriate beneficiary of the Project.

(2) Implementation system

(a) Overall

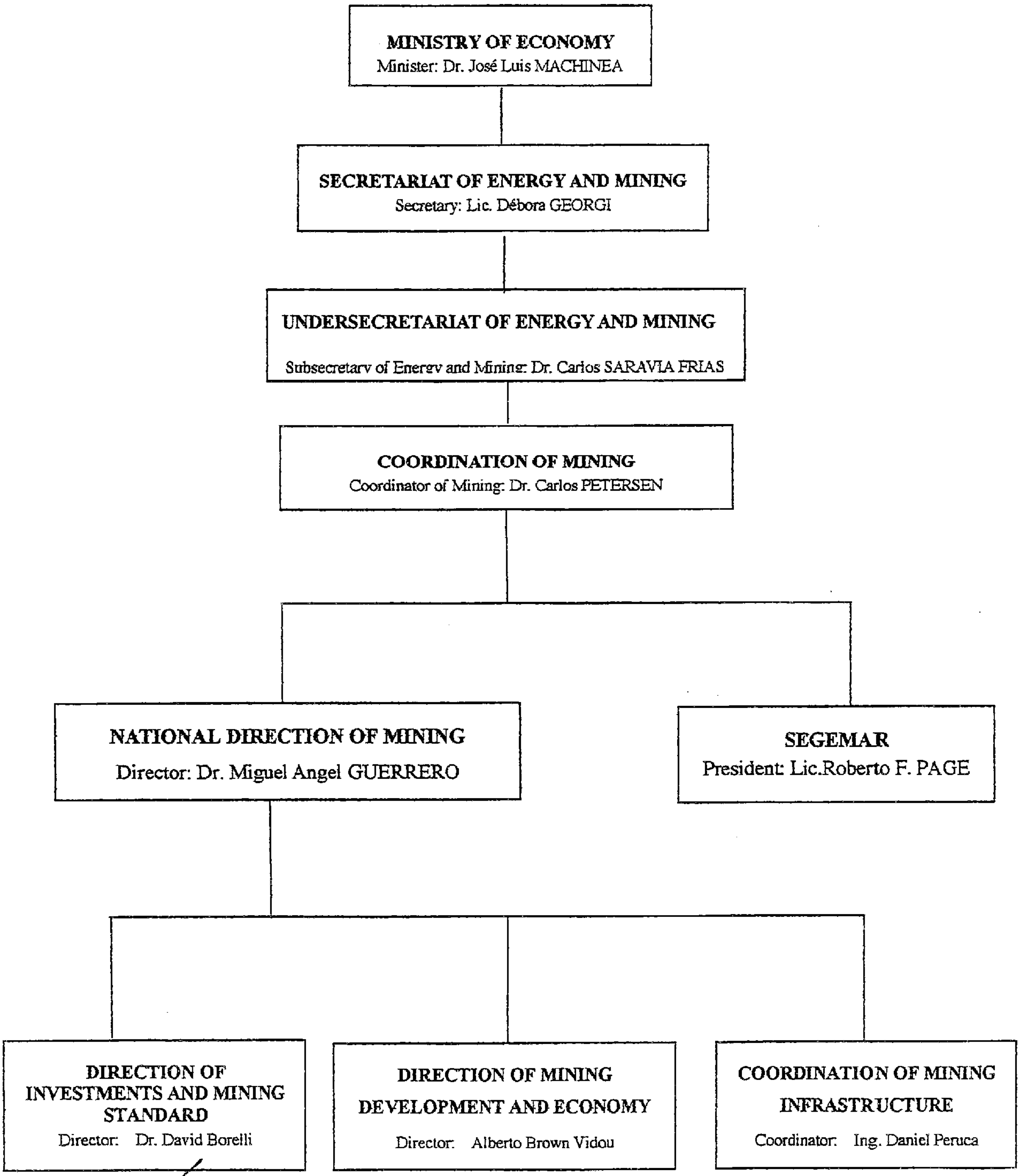
SEGEMAR used to belong to the Secretariat of Industry, Commerce and Mining under the Ministry of Economy. The structural reforms within the Ministry of Economy in 2000 resulted in the mining department being incorporated into the Secretariat of Energy, so that SEGEMAR was to be placed under the auspices of the Secretariat of Energy and Mining.

An organization chart for the Secretariat of Energy and Mining is as shown in next page.

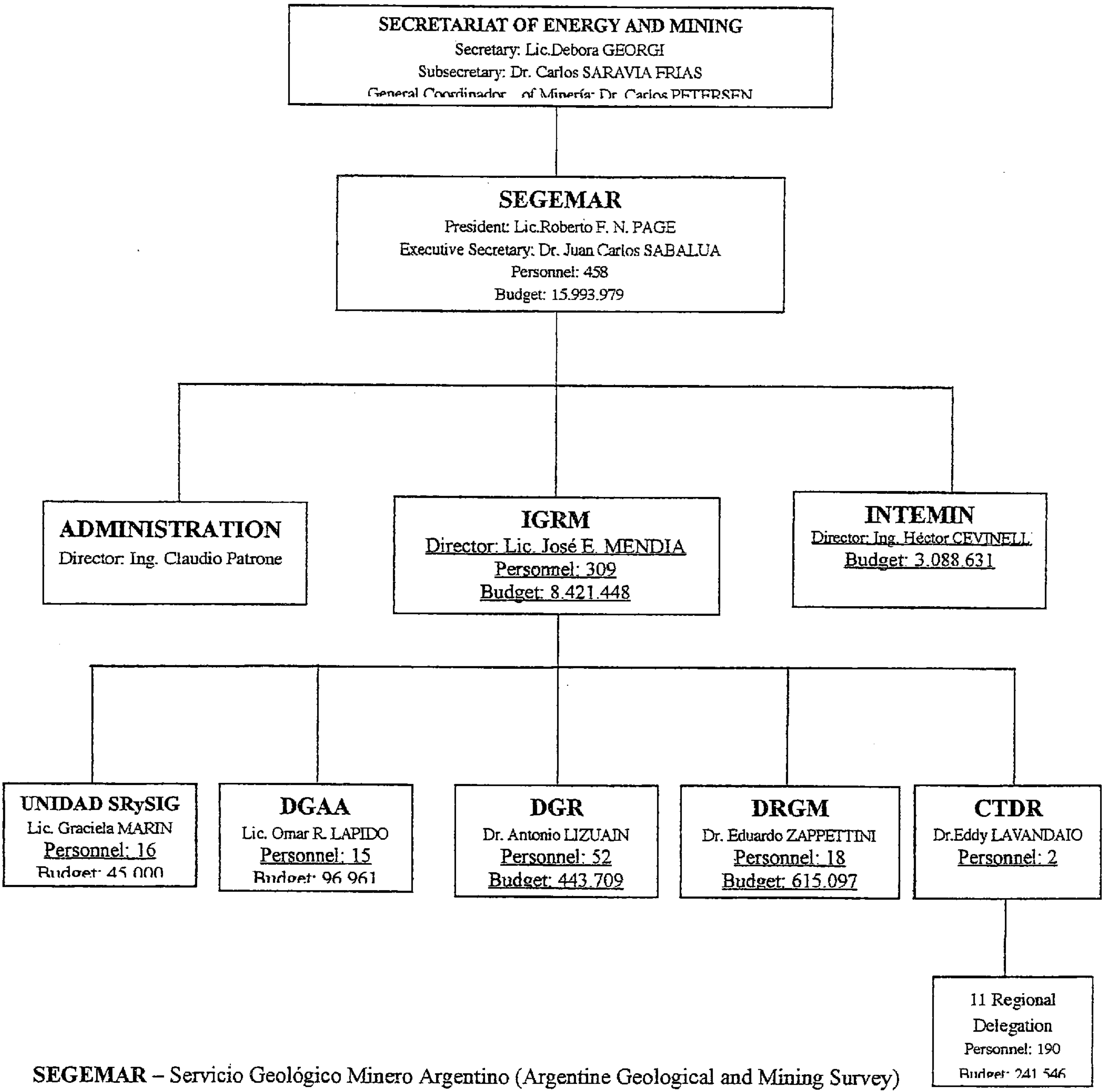
(b) SEGEMAR

SEGEMAR consists of two establishments: Geology and Mining Resources Institute (IGRM) and Mining Technology Institute (INTEMIN). This Project is implemented by IGRM. An organization chart for SEGEMAR and IGRM is as shown in next page.

Organization Chart of the Secretariat of Energy and Mining



Organization Chart of SEGEMAR



SEGEMAR – Servicio Geológico Minero Argentino (Argentine Geological and Mining Survey)
IGRM – Instituto de Geología y Recursos Minerales (Geology and Mineral Resources Institute)
INTEMIN – Instituto de Tecnología Minera (Mining Technology Institute)
DGAA – Dirección de Geología Ambiental y Aplicada (Environmental and Applied Geology Direction)
DGR – Dirección de Geología Regional (Regional Geology Direction)
DRGM – Dirección de Recursos Geológico-Mineros (Geological and Mining Resources Direction)
UNIDAD SRySIG – Unidad de Sensores Remotos y Sistemas de Información Geológica
(Remote Sensing and Geographic Information System Division)
CTDR – Coordinación Técnica de Delegaciones Regionales (Coordination of Regional Delegations)

(c) Past achievements

SEGEMAR has been implementing the Geological and Thematic Maps National Program. With the technology which will have been transferred through this Project, SEGEMAR will be able to create geological maps and thematic maps by processing and analyzing advanced resource satellite data on its own.

2. Availability of Japanese human resources

On the Japanese side, many personnel have been secured, from Earth Remote Sensing Data Analysis Center (ERSDAC) (which processes, analyzes, and researches on ASTER data) and the specialists committee (ASTER Geology Working Group and ASTER Ecosystem Working Group belong to ASTER Science Committee), along with the Metal Mining Agency of Japan (which surveys mineral resources by processing and analyzing satellite data), as well as private mining firms and mining consultants, universities, and national research institutes. Experts will be able to be dispatched from these establishments.

3. Project management system

An organization chart for the Project is attached in the next page.

(1) Project management

President of SEGEMAR, as the Project Director, will bear overall responsibility for the coordination and implementation of the actions and proceedings in order to achieve the general goals of the Project.

Director of IGRM, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

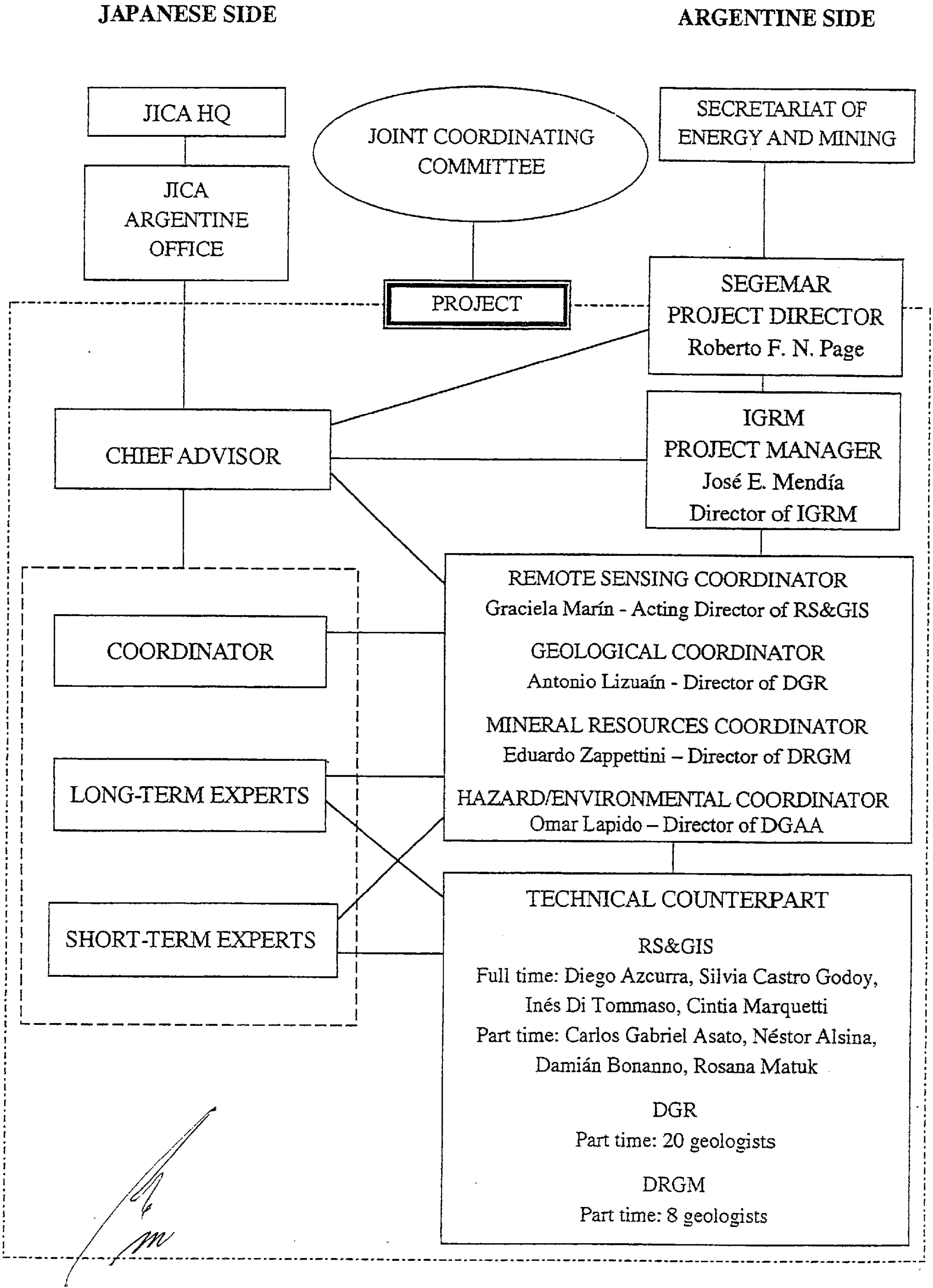
Chief advisor of the Japanese side will, as chief of the Japanese-side expert team, keep deliberating with the Project Director and the Project Manager in organizing the various plans required for implementing the activities and taking measures required for the smooth implementation of the work, while supervising the administration on the Japanese side. Coordinator on the Japanese side will assist to Chief advisor in administering the Project.

Considering the transfer of technology to four departments of personnel, that is RS/GIS Division, DGR, DRGM and DGAA, the chiefs of these departments will join forces to function as Coordinators on the Argentine side. Therefore, they will be responsible for planning, allocating budget, assigning necessary staff, monitoring, and coordinating with organization and/or directions concerned in order to conduct the Project activities smoothly, as C/Ps for Japanese-side Chief advisor and Coordinator.

(2) Joint coordinating committee

Those concerned of both Japanese and Argentine side will be called to meetings of this committee, at least once a year, in order to draft project plans, check their progress, coordinate measures to be taken by both sides, and exchange views on other matters.

Organization Chart of the Project



4. Cooperation system

PASMA project by the World Bank is linked closely to the Project. It aims to build up a system for controlling mining information as described in Chapter 1. "Background Behind the Project," 4. "Previous and ongoing relevant projects." Regarding map information, a database is being developed on the basis of LANDSAT-TM images.

The present Project, on the other hand, is designed to give guidance on the technology for creating content to be actually included in the database. One can therefore say that this Project is complementary to the PASMA project.

One specific form of cooperation is to use the existing database such as one by PASMA project and SEGEMAR's own database. Regarding thematic maps to be created in this project, it is necessary to consider their specifications and specific methods of incorporating it on condition that the data will be incorporated in such databases.

Chapter 7 Sustainability

1. Establishing and Sustaining the technology

For the advanced technology for processing and analyze satellite data (which is to be transferred through the Project) to be transferred continuously within and outside SEGEMAR after the end of the Project, it is imperative that the C/Ps for this Project (such as the RS/GIS Division, DGR, and DRGM) should continue to engage in the current tasks after the end of the Project and that SEGEMAR should establish a system where seminars and other events are held as necessary, in order to transfer the technology to the personnel in the department, other departments, and other establishments. At SEGEMAR, personnel are normally trained continuously within the department, and RS/GIS Division is already implementing a training program for SEGEMAR and non-SEGEMAR engineers, so that there is no problem in this respect.

However, the processing and analysis of satellite data is a technology where technical innovations are still progressing at a rapid rate. It is therefore important for SEGEMAR to keep catching up with the leading-edge technical level, instead of merely retaining the technology transferred through this Project.

2. Development toward higher goals

This Project does not aim merely to allow the C/Ps to learn to process and analyze satellite data. It also aims to allow them to use the technology to arrange data sets, geological maps and thematic maps that will be useful for mineral exploration and other practical purposes. However, in view of the large territory of Argentine, the creation of these data sets, geological maps and thematic maps will not be able to be completed during the Project period. The work to be conducted by the Japanese side during the Project will be confined to the transfer of the technology necessary for carrying out the work. The task of creating the maps will have to be continued upon the responsibility of SEGEMAR during and after the Project.

3. Requirements for sustainability

As described above, sustainability of the Project has two aspects: 1 and 2. The requirements for securing it and the prospects for those requirements to be met are as follows:

① The results of the Project should be important for the implementing agency and the central government.

As is true of any other project, the most important requirement for the continuation and development of the results of the Project is that the implementing agency should understand the importance and usefulness of the results of the Project and should be willing to continue and use those results to the maximum. It is only natural that the implementing agency only has such an understanding when the results of the Project are important for the policy of the entire central government.

In view of the above, "creating geological maps and thematic maps applicable to mineral exploration" which is to be achieved through the Project matches the policy of the Argentine government to arrange geological information quickly in an attempt to promote mining investments. In arranging a Federal Emergency System (a disaster information network), which has been under planning since the former administration, SEGEMAR is exploring the applicability of remote sensing technology. SEGEMAR expects that the use of such technology will be launched by "introducing methods of utilization in the environmental and hazard fields" which is already scheduled for this Project. In that respect as well, the Project is highly significant to the policy of the Argentine government.

② SEGEMAR should continue to take adequate budgetary measures and place sufficient personnel after the end of the Project.

For 1 "Establishing and sustaining the technology" as described above, one should have constant access to the leading-edge satellite data at the moment and have the technical personnel learn the technology for that purpose. The equipment (both software and hardware) should also be constantly upgraded accordingly.

For 2 "Development toward Overall goal" as described above, one should place appropriate personnel and take sufficient budgetary measures to afford expense for satellite data, operational cost and other necessary expense for years until all target areas are covered.

Chapter 8 Project Justification

1. Public interest and fairness of the Project

The Argentine government is aiming at decrease of risk of private companies and promotion of investment through "Preparation of the geological and thematic maps", which is the Overall Goal of the Project, by the government itself. That is, the Project is for public interest as "activities to compensate for the incompleteness of the market (that is, in spite of social necessity, the cost or risk is too large for private sector to bear on its own)". Therefore, it should be implemented by the Argentine government and Japan's Official Development Assistance.

Besides, the geological and thematic maps contribute not only to private companies' activities, but also to policy making and implementation of the government itself, so they should be compiled by the government.

2. Japan's advantage in the target field

In Japan, since the 1980s, researches in image processing to detect geological features using multi-band data obtained from the LANDSAT-TM have been continued by the Geological Survey of Japan, MMAJ, ERSDAC, colleges, metal and mining firms, and other establishments. In hydrothermal alteration zones that imply the presence of metal minerals, it was effective to conduct an elaborate study of the spectroscopic characteristics of gypsum, alunite, clay minerals and other substances that characterize alteration zones.

Altered minerals show absorption peaks characteristic of the respective minerals in the short-wave infrared region, while the LANDSAT-TM covered sensors with only two bands, so that classification of the various minerals could not be sufficiently conducted. Japan then launched JERS-1 incorporating a four-band sensor in the short-wave infrared region. JERS-1 was then used to make attempts to classify the clay minerals in the alteration zones in various parts of the world in the 1990s. Among the subsequent achievements were the successful separation of the acid alteration minerals from the neutral ones in exposures in the USA and Argentine and other exposures where metal mines are known to be distributed, along with the successful extraction of distributions of known gold and silver mines by special band ration.

In estimating mineral compositions of rocks by spectral data, the use of the thermal infrared region is based on the latest technologies. This is based on technologies using the spectral absorption characteristics stemming from Si-O-Si oscillation in the thermal infrared region. This means that rocks with high SiO_2 content show great absorption characteristics, while those with low SiO_2 content show less remarkable absorption characteristics. In the estimation of the silica content of rocks using spectral data in the thermal infrared region, the LANDSAT-TM as we knew it was inapplicable because it had only one band in the thermal infrared region. ASTER, the new sensor developed jointly by Japan and the USA, had five bands in the thermal infrared. This is expected to enable the lithological classification of rocks by silica content.

Japan has so far continued cooperative exploration for mineral development in the Andean mountainous areas in Argentine as a project of JICA-MMAJ. JAPAN is thus well versed in the local geology of Argentine. As a country ready to offer technical cooperation with its latest remote sensing technology and information about metal resources, Japan can meet the requirements of the recipient country.

3. Magnitude of expected impact

(1) Impact on the policy

The previous geological surveys have reached a point where the geological map on a scale of 1:250,000 covers most of the major mineral resource areas. However, these centers are located on the Andean region in the northwest and information density varies from area to area, thus being not enough to cover the entire nation. If, as a result of this Project, one can have an overview of resource potential on the same level throughout the country, an elaborate study will be conducted of the geological distribution in the entire country. This will enable a short-time grasping of the geological condition of areas overlooked so far and regions whose geological maps are still unavailable. Information thus obtained will not only be useful for private investors but also be important for the Argentine government as basic data with which the government can control underground resources on its own and draft mining policies.

Remote sensing technology has potential for effective use not only in mineral exploration but also in land control, hazard prevention, environmental preservation, and various other fields. However, until now, no remote sensing technology on a leading-edge level has been used on full scale at any governmental organization in Argentine. The buildup of a geological information database based on advanced remote sensing which the Project will enable SEGEMAR to implement can be called the first such attempt. The results of the Project may therefore also affect the policy of federal governmental organizations planning to use remote sensing. Such governmental establishments include the Agricultural Institute (INTA), Water Resources and Environmental Institute (INA), Statistics Bureau (INDEC), Nuclear Institute (CNER), Geographical Institute (IGM), Earthquake Institute (INPRES), and Aeronautic Institute (CONAE). As described above, SEGEMAR itself wishes to use remote sensing technology in "establishing a federal emergency system," a policy of laying an information network regarding hazard information being planned since the former administration. In response to that, the Project is also scheduled to present to SEGEMAR staff how to use remote sensing in hazard and environmental analysis

(2) Economic impact

The mining boom in Argentine in 1992 and 1993 involved a rise in direct investments to $2 billion and total investments of $250 million in mineral exploration during the six years from 1994 through 2000. For the next two years, the Lama gold and silver mines are expected to receive $900 million of investments, and the Veladero gold and silver mines $500 to 600 million. Thus, mining development has a very great economic impact on the country.

The renewed mining laws of 1993 resulted in the Mining Modernization Law stipulating the integration of geological information. However, work only progressed slowly. After the technology transfer through the Project, geological information that is highly precise and contributes directly to mining development is expected to be arranged speedily. When the public is informed that they have access to direct information that is effective in metal mineral exploration, such as lithologic classification by silica content and classification of thermally altered minerals that traditional LANDSAT-TM imagery can not analyze, small and mid-size mining firms will have higher access to such open geological information. However, many largest firms are projected to be a little doubtful of such open geological information without believing in such new information until they confirm the conformity of such information to existing geological information on their own. After those firms become more aware of the high conformity to actual geological condition and the analysis procedure, they are expected to begin using such open geological information more widely.

The use of such geological information by mining investors will have a great impact on the Argentine economy as follows:
① some of the mining costs will be reduced;
② the national mining activities will be reactivated, with mining and peripheral industries (such as material and equipment suppliers, transporters, and various mining service firms);
③ the arrangement of geological information will improve the investment environment, thus luring foreign capital;
④ mine development will be accompanied by a better-established infrastructure in the peripheral areas;
⑤ useful resources in the country will be efficiently developed, resulting in greater exports;
⑥ higher tax incomes will reach the provincial and federal governments, resulting in a better financial condition.

In fact, activity in the Alumbrera mine results in $300 million being applied each year to the community. Activity in the Veladero mine results in about $40 million being loaded to the community. It is a fact that the life level of people living in and around the mines is improving. In the Alumbrera mine district, for example, car ownership rose from 1 car for every 8 persons to 1 car for every other person now. Another statistic shows that electrical appliances used to be found only in one out of every 8 households and is now owned by all 8 households. Thus, the impact is vast on the peripheral society, in terms of food, clothing, housing and other commodities supporting mine workers.

In the mining development projects so far, investments centered around promising areas whose metallurgic characteristics had already been known. But most of these efforts seem to be complete. Traditional methods therefore cannot easily extract promising regions in unexplored areas. When SEGEMAR will extract areas with mineral resource potential in undeveloped areas, as the result of the Project, and make the information open to entities both at home and abroad, the public will recognize the potential in new areas, which is expected to result in foreign capital being lured either directly or indirectly.

(3) Social impact

(a) Economic effects of mine development

The primary social impact of the Project involves such economic effects as a lower jobless rate, higher incomes, and the arrangement of roads, electricity, gas and other infrastructure in peripheral areas through the development of mines, as described in (2) "Economic Impact" as described above.

- Characteristics of the beneficiary groups

As described above, the highest potential for mineral resources in Argentine is said to be in northern areas with the lowest income levels in the country. Promoting the economic development in those areas is therefore greatly significant in correcting the gaps between areas.

- Size of the beneficiary groups and the nature of benefits

The mining population today totals about 20,000, with about 80 foreign firms engaged in mining. However, small and mid-size firms registered with the Secretariat of Energy and Mining as mining firms total about 500. These, together with unregistered ones, total more than 800 small and mid-size mining companies. If all these firms come to use geological information to be disclosed by the federal government, the private groups who will benefit directly can be calculated on a trial basis to be 20,000 to 30,000 persons. These, together with their family members, will amount to a number as large as 100,000 persons (assuming that each company has 30 employees and each such employee has a four-member family). Based on such geological information, these firms will apply for a mine claim. As exploration heats up, peripheral service firms will abound, resulting in tens of thousands of people engaged in them benefiting from the profits. Furthermore, if a specific area is to be developed as a mine, additional beneficiaries will spring up, including new employees and their family members, totaling a few thousand. Peripheral industries will then involve four times as many beneficiaries, or about 10,000 direct or indirect beneficiaries per mine. The launch of several such mines will bring about a total of about hundreds of thousands of direct and indirect beneficiaries. Under these circumstances, business operators in various parts of the world will use geological information which will have been disclosed by the federal government in order to invest in mining in Argentine. The result will therefore be a considerable number of indirect beneficiaries. If, in addition, there occurs a craze for investments in mining as the one that occurred once, one cannot predict how many people will benefit.

The Alumbrera mine and the Hombre Muerto mine in the Catamarca Province, which launched production in 1997, employed about 900 additional direct workers. They were then joined by 4,000 mine-related workers engaged in indirect material supply. The Pascua Lama mine in Chile, a mine close to the Argentine-Chile border, will launch production in 2003 and is projected to hire about 4,000 mine workers, of which about 80% come from Argentine. Thus, mine development needs large numbers of workers. It is therefore beyond doubt that mine development will make a considerable contribution to a decline in the domestic jobless rate, which is still as high as 14%.

(b) Arrangement of information about disaster prevention and environmental issues and other information required for citizens' lives

Remote sensing is considered to be useful in monitoring and analysis for hazard prevention and environmental preservation. Researches in that area are also under way in Japan. Through the Project, therefore, an introduction is scheduled to be made to possible ways of using remote sensing in such monitoring and analysis applications. The "introduction of utilization methods" in this Project will not be enough for the C/Ps themselves to learn how to conduct actual monitoring and analysis and reach a level where they can do them on their own. However, this can presumably be an opportunity for SEGEMAR itself to address aggressively the use of remote sensing in this area. If SEGEMAR makes effort by itself and, in the future, actually conducts monitoring and analysis in hazard prevention and environmental preservation by remote sensing, it will be possible to obtain information about natural disasters in an efficient, effective manner, and this is expected to increase safety in urban planning and infrastructure arrangement.

(4) Technical impact

The technology transfer was described in 5. "Basic Project Plan." It will therefore not be detailed here. The anticipated impact of the technology transfer covered in this Project will come in the following two forms.

The greatest advantage of the technology transfer covered will be that information that has only been accessible through field geological surveys will be comparatively easy to obtain by processing and analyzing satellite data, so that new maps such as altered minerals maps and lithological maps by silica content, which have not been created, can be prepared and added to the content of the for National Geological and Thematic Maps Program.

The other great advantage is that the use of lithological maps by silica content and other satellite data (such as digital elevation maps, or DEM) will largely shorten the time requirement for creating geological maps, as well as improve precision of the maps.

(5) Comprehensive evaluation of the impact

As described above, this Project is expected to have a positive impact in various aspects.

However, some impacts, particularly (2) "Economic Impact" and (3) "Social Impact," cannot be produced directly by this Project. These impacts only show themselves when the technology which will have been transferred through this Project is used by SEGEMAR to arrange geological and thematic maps and when these resulting maps are then used by mining investors. For this Project to pay off, it is very important to arrange a system where mining investors and other stakeholders can use geological information arranged by SEGEMAR. In this respect, one effective way may be to use Internet web-site as a tool of information distribution as described above. In addition, SEGEMAR itself wishes ① to distribute information to federal governmental establishments and provincial governments free of charge, ② to publish geological maps, manuals, analysis result reports, and other documents, ③ to publicize such information on a web-site, ④ to hold two to four workshops a year, and ⑤ to announce papers at meetings of related academic societies. It is therefore considered that the way has been paved for the impact to show itself.

ANNEX 18

List of Attendance at the Meetings

Argentine Side

(1)Secretariat of Energy and Mining

Mr. Carlos A. Petersen	General Coordinator of Mining

a. SEGEMAR

Mr. Roberto F. N. Page	President
Mr. Juan Carlos Sabalúa	Executive Secretary (Secretario Ejecutivo)
Mr. José E. Mendía	Director of Geology and Mineral Resources Institute (Instituto de Geología y Recursos Minerales : IGRM)
Ms. Graciela Marín	Acting Director of Remote Sensing and GIS Division (Unidad de Sensores Remotos y Sistema de Información Geografica : Unidad SR y GIS), IGRM
Mr. Antonio Lizuain	Director of Regional Geology Direction (Dirección de Geología Regional : DGR), IGRM
Mr. Mario R. Franchi	Coordinator of Geological Maps Program, IGRM
Mr. Eduardo Zappettini	Director of Geological and Mining Resources Direction (Dirección de Recursos Geológico Mineros : DGRM), IGRM
Mr. Omar R. Lapido	Director of Environmental and Applied Geology Direction (Dirección de Geología Ambiental y Aplicada : DGAA), IGRM
Mr. Carlos Gabriel Asato	Staff of Remote Sensing and GIS Division, IGRM

b. National Direction of Mining

Mr. Miguel A. Guerrero	National Director of Mining

c. Expert of JICA

Mr. Kyoichi Koyama	Expert of Investment Promotion for Exploration and Mining

(2) Ministry of Foreign Affairs

Mr. Fernando R. Lerena	Director of Bilateral Cooperation
Andrea De Fornasari	Staff of Bilateral Cooperation

Japanese side

(1) Implementation Study Team

Mr. Masahiko Kaneko	Leader
Mr. Katsumi Yokokawa	Technical Transfer Planing
Ms. Yukari Saito	Cooperation Planning

(2) JICA Argentine Office

Mr. Masahiro Kumomi	Resident Representative
Mr. Yutaka Iwatani	Deputy Resident Representative
Mr. Juan Carlos Yamamoto	Staff